Minutes of Evidence
taken before the Depart
mental Committee on
Industrial Alcohol
with appendices

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INDUSTRIAL ALCOHOL COMMITTEE.

MINUTES OF EVIDENCE

TAKEN BEFORE THE

DEPARTMENTAL COMMITTEE

ON

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INDUSTRIAL ALCOHOL,

WITH APPENDICES.

ROYAL ASIAT LIBR OF

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1905.

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TABLE OF CONTENTS.

	PAGE
Alphabetical List of Witnesses	iii.
List of Witnesses in order of attendance	v.
Minutes of Evidence	1.
Appendix	229
Index	281

ALPHABETICAL LIST OF WITNESSES

WITH DESCRIPTIONS

AND REFERENCE TO PAGE OF MINUTES OF EVIDENCE.

Name of Witness.	Description.	Page.
Ashworth, Mr. A.	Chemical Manufacturer, Bury (Lancs.)	174
Bagley, Mr. W. H.	Representing Messrs. Samuel Heath and Sons, Limited, Brassfounders, Birmingham.	74
Barlow, Mr. F.	Representing the Birmingham Lacquer Company, Limited	77
Biggs, Mr. B.	Representing the Wood Distilling Industry of Great Britain	162
Boys, Professor C. V., F.R.S.	Representing the Automobile Club	183
Cash, Mr. J.	Late Chairman of the New Artificial Silk Company, Limited	209
Clarke, Mr. A. T.	General Manager to the Hentschel Colourtype (1901) Limited; representing the Federation of Master Printers and Allied Trades	151
Cocking, Mr. A. T.	Resident Director of Messrs. Kynoch, Limited	143
Conroy, Dr. J. T.	Chemist to the United Alkali Company, Limited	128
Dreyfus, Dr. C.	Manager Director of the Clayton Aniline Company	62
Edwards, Mr. W. M.	Director of Messrs. Christopher Thomas & Brothers, Limited, Soap Manufacturers, Bristol.	153
Entwistle, Mr. H.	Representing the Manchester Process and Wood Engravers' Association	28
Friswell, Mr. R. J., F.I.C., etc.	Late Director and Manager of Messrs. Brooke, Simpson & Spiller, Limited, Aniline Dye Manufacturers.	1
Gardiner, Mr. T.	Manager to Messrs. A. Lambley & Sons, Manufacturers of Lacquer, etc., Birmingham.	90
*Gittings, Mr. J. J.	Managing Director of Messrs. Gittings, Hills & Boothby, Limited, Manufacturers of Lacquer, etc., Birmingham.	135
Green, Professor A. G.	Professor of Tinctorial Chemistry and Dyeing at the Yorkshire College, Leeds.	15
Griffith, Mr. R. W. S.	Representing the Schultze Gunpowder Company, Limited	69
§Grimwade, Mr. E. W.	Representing Messrs. Grimwade, Ridley & Co., Australian Merchants, Trinity Square, E.C.	80
Hinchcliff, Dr. J. H.	Agricultural Inspector to the Department of Agriculture and Technical Instruction for Ireland.	219
§Howard, Mr. D.	Chairman of Messrs. Howards & Sons, Limited, Manufacturers of Pharmaceutical Products and Fine Chemicals.	105
Leitch, Mr. J. W.	Representing Messrs. John W. Leitch & Co., Aniline Dye Manufacturers, Huddersfield.	125
‡Levinstein, Dr. H., M.Sc.	Representing Messrs. Levinstein, Limited, Manufacturers of Coal Tar Colours, Manchester.	7
Macwalter, Mr. T.	Representing Messrs. Elliott & Son, Limited, Manufacturers of Photographic Materials, Barnet.	160
Massey, Mr. W. H., M.I.C.E.	Electric Light Engineer, Lord Steward's Department, Buckingham Palace.	180
Meldola, Professor R.	Professor of Chemistry, Finsbury Technical College	55
Merriam, Mr. C. P.	Representing the British Xylonite Company	50
Nicholson, Mr. R. F.	Managing Director of Messrs. J. & W. Nicholson & Co.; representing the Distilling Industry.	195
‡Ormandy, Dr. W. R.	Chemist to Messrs. Crosfield & Sons, Limited, Warrington	37

* Deputed by the Birmingham Chamber of Commerce.
† Deputed by the Liverpool Chamber of Commerce.
‡ Deputed by the Manchester Chamber of Commerce.
§ Deputed by the London Chamber of Commerce.
‖ Deputed by the Association of Chambers of Commerce of the United Kingdom.

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Name of Witness.	Description.	Page.
ORMANDY, Dr. W. R. (recalled)	Representing the Society of Motor Manufacturers and Traders -	81
PERKIN, Dr. W. H. - - -	Member of the late firm of Messrs. Perkin & Sons, and discoverer of the first Aniline Dye.	46
‡RÉE, Dr. A. - - - - -	Representing Messrs. Claus & Rée, Chemical Manufacturers, Manchester	30
*REID, Mr. W. F. - - -	Technical and Consulting Chemist - - - - - - - - -	120
SILBERRAD, Dr. O. - - -	Superintendent of Chemical Research under the Explosives Committee of the War Office.	99
SMITH, Mr. G., F.I.C., etc. -	Works Manager to Messrs. Nobel's Explosives Company, Limited -	189
TULLOCH, Captain T. G., late R.A.	Technical Manager to the Chilworth Gunpowder Company - - -	93
†TURNER, Mr. J. - - - -	Chairman of Messrs. Read, Holliday & Sons, Limited, Aniline Dye Manufacturers, Huddersfield.	168
*UMNEY, Mr. J. C. - - -	Director of Messrs. Wright, Layman & Umney, Limited, Manufacturing Pharmacists.	116
WALKER, Mr. A. - - -	Partner in the Firm of Messrs. Archibald Walker & Co., Liverpool and Limerick, and Director of the Distillers Company, Limited, and the Vauxhall Methylating Company; representing the Distilling Industry.	200
*WEBB, Mr. E. A. - - -	Director of Messrs. Evans, Sons, Lescher & Webb, Limited, Manufacturing Druggists, London and Liverpool.	111
†WHITAKER, Mr. T. - - -	Representing the Bradford Dyers' Association, Limited - - -	156
WHITE, Mr. E. - - - -	Representing Messrs. Alfred White & Sons, Manufacturers of Ethers, etc., London and West Drayton.	205
WIGGLESWORTH, Mr. J. - -	Representing Messrs. Hodgson & Simpson, Soap Manufacturers, Wakefield.	24

* Deputed by the London Chamber of Commerce.
† Deputed by the Association of Chambers of Commerce of the United Kingdom.
‡ Deputed by the Manchester Chamber of Commerce.

LIST OF WITNESSES IN ORDER OF ATTENDANCE.

Date.	Names.	Description.	Page of Minutes of Evidence
First Day—			
November 8th, 1904	Mr. R. J. FRISWELL	Late Director and Manager of Messrs. Brooke, Simpson & Spiller, Ltd., Aniline Dye Manufacturers.	1
" "	Dr. H. LEVINSTEIN, M.Sc.†	Representing Messrs. Levinstein, Limited, Manufacturers of Coal Tar Colours, Manchester.	7
Second Day—			
November 16th, 1904	Professor A. G. GREEN*	Professor of Tinctorial Chemistry and Dyeing at the Yorkshire College, Leeds.	15
" "	Mr. J. WIGGLESWORTH	Representing Messrs. Hodgson & Simpson, Soap Manufacturers, Wakefield.	24
" "	Mr. H. ENTWISTLE	Representing the Manchester Process and Wood Engravers' Association.	28
Third Day—			
November 22nd, 1904	Dr. A. RÉE†	Representing Messrs. Claus and Rée, Chemical Manufacturers, Manchester.	30
" "	Dr. W. R. ORMANDY†	Chemist to Messrs. Crosfield & Sons, Ltd., Warrington.	37
Fourth Day—			
November 23rd, 1904	Dr. W. H. PERKIN	Member of the late firm of Messrs. Perkin and Sons, and discoverer of the first Aniline Dye.	46
" "	Mr. C. P. MERRIAM	Representing the British Xylonite Company	50
Fifth Day—			
November 29th, 1904	Professor R. MELDOLA	Professor of Chemistry, Finsbury Technical College.	55
" "	Dr. C. DREYFUS†	Managing Director of the Clayton Aniline Company.	62
Sixth Day—			
November 30th, 1904	Mr. R. W. S. GRIFFITH	Representing the Schultze Gunpowder Company, Ltd.	69
" "	Mr. W. H. BAGLEY‡	Representing Messrs. Samuel Heath and Sons, Ltd., Brassfounders, Birmingham.	74
" "	Mr. F. BARLOW‡	Representing the Birmingham Lacquer Company, Limited.	77
Seventh Day—			
December 6th, 1904	Mr. E. W. GRIMWADE*	Representing Messrs. Grimwade, Ridley and Co., Australian Merchants, Trinity Square, E.C.	80
" "	Dr. W. R. ORMANDY (recalled)	Representing the Society of Motor Manufacturers and Traders.	81
" "	Mr. T. GARDINER	Manager to Messrs. A. Lambley & Sons, Manufacturers of Lacquer, etc., Birmingham.	90
Eighth Day—			
December 7th, 1904	Captain T. G. TULLOCH, late R.A.	Technical Manager to the Chilworth Gunpowder Company.	93
" "	Dr. O. SILBERRAD	Superintendent of Chemical Research under the Explosives Committee of the War Office.	99
Ninth Day—			
December 13th, 1904	Mr. DAVID HOWARD*	Chairman of Messrs. Howards & Son, Ltd., Manufacturers of Pharmaceutical Products and Fine Chemicals.	105
" "	Mr. E. A. WEBB*	Director of Messrs. Evans, Sons, Lescher and Webb, Manufacturing Druggists.	111
December 13th, 1904	Mr. J. C. UMNEY*	Director of Messrs. Wright, Layman and Umney, Ltd., Manufacturing Pharmacists.	116

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‡ Deputed by the Birmingham Chamber of Commerce.

Date.	Name.	Description.	Page of Minutes of Evidence
Tenth Day—			
December 14th, 1904	Mr. W. F. Reid*	Technical and Consulting Chemist.	120
„ „	Mr. J. W. Leitch	Representing Messrs. John W. Leitch & Co., Aniline Dye Manufacturers, Huddersfield.	125
„ „	Dr. J. T. Conroy§	Chemist to the United Alkali Company, Limited.	128
Eleventh Day—			
December 20th, 1904	Mr. J. J. Gittings‡	Managing Director of Messrs. Gittings, Hills & Boothby, Ltd., Manufacturers of Lacquer, etc., Birmingham.	135
„ „	Mr. A. T. Cocking‡	Resident Director of Messrs. Kynoch, Ltd.	143
„ „	Mr. A. T. Clarke	General Manager to the Hentschel Colourtype (1901) Ltd.; representing the Federation of Master Printers and Allied Trades.	151
Twelfth Day—			
January [illegible], 1905	Mr. W. M. Edwards‖	Director of Messrs. Christopher Thomas & Brothers, Ltd., Soap Manufacturers, Bristol.	153
„ „	Mr. Thorp Whitaker‖	Representing the Bradford Dyers' Association, Ltd.	156
„ „	Mr. T. Macwalter	Representing Messrs. Elliott & Sons, Ltd., Manufacturers of Photographic Materials, Barnet.	160
Thirteenth Day—			
January 10th, 1905	Mr. B. Biggs	Representing the Wood Distilling Industry of Great Britain.	162
„ „	Mr. J. Turner‖	Chairman of Messrs. Read, Holliday & Sons, Ltd., Aniline Dye Manufacturers, Huddersfield.	168
„ „	Mr. A. Ashworth‖	Chemical Manufacturer, Bury, Lancs.	174
„ „	Mr. W. H. Massey, M.I.C.E.	Electric Light Engineer, Lord Steward's Department, Buckingham Palace.	180
Fourteenth Day—			
January 31st, 1905	Professor C. V. Boys, F.R.S.	Representing the Automobile Club.	183
Fifteenth Day—			
February 1st, 1905	Mr. G. Smith, F.I.C., etc.	Works Manager to Messrs. Nobel's Explosives Company, Ltd.	189
„ „	Mr. R. F. Nicholson	Managing Director of Messrs. J. & W. Nicholson & Co.; representing the Distilling Industry.	195
„	Mr. A. Walker	Partner in the firm of Messrs. Archibald Walker & Co., Liverpool and Limerick, and Director of the Distillers' Company, Ltd., and the Vauxhall Methylating Company; representing the Distilling Industry.	200
Sixteenth Day—			
February 8th, 1905	Mr. E. White	Representing Messrs. Alfred White & Sons, Manufacturers of Ethers, etc., London and West Drayton.	205
„ „	Mr. J. Cash	Late Chairman of the New Artificial Silk Company, Ltd.	209
Seventeenth Day—			
February 17th, 1900	Dr. J. H. Hinchcliff	Agricultural Inspector to the Department of Agriculture and Technical Instruc for Ireland.	219

* Deputed by the London Chamber of Commerce.
† Do. do. Manchester do.
‡ Do. do. Birmingham do.
§ Do. do. Liverpool do.
‖ Do. do. Association of Chambers of Commerce of the United Kingdom.

MINUTES OF EVIDENCE

TAKEN BEFORE THE

COMMITTEE APPOINTED TO INQUIRE INTO THE USE OF

DUTY-FREE ALCOHOL FOR INDUSTRIAL PURPOSES,

AT SOMERSET HOUSE, LONDON, W.C.

FIRST DAY.

Tuesday, 8th November, 1904.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair.*)

Professor Sir WILLIAM CROOKES, F.R.S.
Sir W. H. HOLLAND, M.P.
The Hon. J. SCOTT-MONTAGU, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM, (*Secretary*).

Mr. R. J. Friswell.

8 Nov. 1904.

Mr. RICHARD JOHN FRISWELL, called; and Examined.

1. (*Chairman.*) You have been kind enough to say you will give the Committee the benefit of your experience in connection with the aniline dye trade. I understand that you have been associated with that trade from March, 1874?—Yes.

2. In connection with the firm of Brooke, Simpson & Spiller?—That is so.

3. That firm was converted into a company in 1886, I understand?—Yes.

4. Thereupon you became a director of the company and manager of the works?—Yes.

Aniline Dye Industry. Introduction of Azo-dyes, made by aqueous solution, has decreased relation importance of alcohol.

5. You left it in 1899, but you have still kept up a certain amount of touch with the industry?—That is so.

6. During that period, from 1874 to 1899, were there any considerable changes either in the articles that were produced or in the methods of production?—There were very great changes in the shape of the introduction of an entirely new group of dyes, known as the azo dyes. The first of them was the Bismarck brown, unless we go back to a somewhat earlier one, an aniline yellow, which had almost become obsolete before the Bismarck brown was introduced. They began to develop with great rapidity in the year 1876 or 1878, by the production of an immense number of scarlets and oranges, all prepared by that re-action, and entirely prepared by the use of an aqueous solution. In that way there was a departure from the previous style of manufacture, which, in the case of dyes belonging to the triphenyl rosaniline group (that is to say, the blues and all the intermediate products between that and rosaniline), and in the case of the methylated rosanilines—those are the violets and some of the greens—involved the use of an alcoholic solution on a very large scale, even apart from the question of the introduction of alcoholic groups into the dyes themselves. So that the change was away from the alcohol.

7. Did that diminish the demand for alcohol in connection with the industry?—No, it did not diminish the demand. The demand remained fairly constant. The great increase was in another direction, so that the relative proportion of alcohol to the total quality of the dyes made was less.

8. Was the alcohol more used in incorporating the alcoholic radical in the dye and less for the purposes of solution, or the reverse?—The great use was for the purposes of solution. In the early history of the industry alcohol was almost exclusively used. The first dye was discovered—that known as mauve, which was discovered by Mr. Perkin, I think, in 1854, but I am not certain—was sold entirely as an alcoholic solution originally.

Original dyes sold in alcoholic solution

9. That is, it was sold as a liquid solution?—It was sold as a liquid solution, and not in the solid form. I believe the same is true of the first rosaniline. That was made by the action of mercuric nitrate on aniline. That was a French discovery that began to be worked in this country, I believe, in 1859. In 1860 Mr. Nicholson discovered the method of making rosaniline, that is to say magenta, as it is more generally known now, by the action of arsenic acid on aniline, that is to say, it was really a mixture of aniline and toluidine, but it was known as aniline. The discovery was made almost simultaneously—really a few days earlier—by a chemist named Medlock.

Preparation of actual colouring matter, without alcohol, in 1860.

10. A chemist in this country?—Yes, both were chemists in this country. From that time the alcoholic solutions of these colours disappeared, because Nicholson did what up to that time no one had done before, that is, he produced the actual colouring matter. At first these things were made in the form of a crude mass or melt. The necessary oxidiser was mixed with the so-called aniline and the mass was heated and then it was dissolved in spirits, and after undergoing some slight purification was sold as an alcoholic solution. But when Nicholson got to work upon it he immediately went behind all such processes by producing the actual chemical individual, the hydro-chloride of rosaniline. I believe at first he produced an acetate of rosaniline. That is to say, the thing which was the colouring matter of these crude masses which contained this true colouring matter in addition to unaltered aniline, and unconsumed oxidiser and the consumed oxidiser and certain bye-products. He separated the true colouring matter. That was by a process of aqueous treatment. In the year 1862, at which time the acetate of rosaniline was selling at three

Mr. R. J. Friswell.

8 Nov. 1904.

guineas an ounce, he exhibited a wire crown in the exhibition which had crystallised on it 80 lbs. of rosaniline acetate in large crystals, the crystals being three-quarters of an inch or more in length.

11. Did he produce those by this new process?—He produced them by the arsenical process, and afterwards separated them purely by a system of aqueous solution. The arsenical matter, the crude matter, was boiled with water, the arsenic compounds were removed with lime, and the colour base was separated by crystallizing it in water, drying it, and then dissolving it in acetic acid and water, when it crystallised from the water as acetate.

Development of Azo colours the result of discoveries made abroad.

12. Were these changes that you have mentioned just now as having taken place from about 1876 the result of discoveries made in this country or of discoveries made abroad?—The movement in the direction of the azo colours was the result of discoveries which were practically all made abroad. The original discoveries were made here by Mr. Peter Griess, who was a chemist in the employ, I think, of Messrs. Allsopp & Company at that time; but they had not been properly studied and worked here.

13. Then the development so as to make them commercially applicable came from abroad?—Yes.

German competition. (*See* also Qs. 26.)

14. During those twenty-five years was the competition from manufacturers abroad, especially in Germany, increasing?—It was constantly increasing the whole time.

15. When did it begin to be severely felt?—About 1885 or 1886.

Inactive attitude of British manufacturers not attributed to difficulties in connection with alcohol. (*See* also Qs. 80–82).

16. Not before that?—No. Up to that time there were very substantial profits arising, but before that the commercial people had adopted the opinion that the aniline dye industry was played out, and that nothing more was to be done here.

17. When you say the commercial people, do you mean the people who used the dyes?—No, I mean those who had the control of the manufacture of the dyes.

18–20. Was that opinion, do you think, the result of the German competition beginning to make itself felt?—I think it was the result of an absolute want of knowledge of the subject,—at least, that is the only way in which I can account for it.

21. Then so far as your knowledge of the circumstances goes, as I gather, the difficulties in connection with alcohol did not influence their judgment at all?—Those difficulties never arose; at that time, they were making very large profits out of these substances.

Export trade in colours, 1874 to 1899.

22. Before we leave the history of the business during those twenty-five years could you tell us whether there was any export trade?—Yes, there was a considerable export trade, originally to France and the east, and gradually that was extended until there was an export trade to Germany in certain partly manufactured articles. There was also a very large export trade to the United States at one time, but that shrunk very much because of the imposition of the Dingley tariff, which imposed a specific duty of 1 dollar per lb. and 35 per cent. ad valorem.

23. The Dingley tariff came into force about 1892, did it not?—I think it was earlier than that.

24. At any rate, it was somewhere about that date; but up to that there was a good export business?—There was a very large trade with America.

25. Of the total output do you suppose that the larger part was exported, or was the larger part consumed in this country?—At that time I knew very little about the commercial side of the business, but I should say that much more was consumed in Great Britain—in England and Scotland mainly.

Foreign Competition, 1874 to 1899.

26. Were the same articles that you were manufacturing imported from abroad to any extent?—No; the Hofmann violets were patented in this country, and therefore they would not be imported. The blues, the odies derived from triphenyl rosaniline, were imported. I think you may say that the German opposition began by the import of what were known as the Nicholson blues. Those were the blues discovered by Nicholson and made by the action of sulphuric acid on the blues derived from rosaniline.

27. Is your old company still in business?—It went into liquidation, and then it was subsequently removed from liquidation.

Alcoholic materials used. Mainly methylated spirit for solution and purification.

28. During the period you were connected with the business large quantities of alcoholic materials were used in the process of manufacture, and in the *précis* of your evidence you have named three forms of alcoholic materials, namely, methylic alcohol, methyl iodide, and dimethyl aniline, which you say are all used in the direct synthesis of colours, and you go on to say that "also as a medium for solution, and in the purification, etc., of such colours from 10,000 to 20,000 gallons per annum of methylated spirit was used" by the firm of Messrs. Brooke, Simpson, & Spiller, when you were connected with it; but you do not mention anything as regards the quantities of methylic alcohol that was used. Would those quantities of alcohol in the three forms of alcohol or alcoholic material exceed what was used for solution and purification?—No, they would be very much less. I think, if you will excuse me, that you will find later on in my *précis* I do mention the fact that at one period, the period of greatest activity, a certain quantity of methyl iodide was used.

For synthesis methyl iodide,

29. Yes, but that is a very small quantity?—Fifteen tons per annum.

30. I make out from your calculation that in that fifteen tons of methyl iodide there would not be more than about 400 or 500 gallons of alcohol?—It would be a very small quantity.

methylic alcohol, for making methyl iodide,

31. Now, what sort of quantity in gallons do you suppose that you used of methylic alcohol?—That would be the methylic alcohol that we were dealing with just now which was converted into methyl iodide. Methylic alcohol was used for making methyl iodide.

32. Did you not use methylic alcohol in itself?—A small quantity was always put into the autoclaves in which the methyl iodide was heated with the rosaniline base. It was quite a small quantity.

and dimethyl aniline (imported).

33. I understand that your third alcoholic material, dimethyl aniline, was practically always imported?—We always imported that, we never made it.

34. Was the quantity of that large?—The quantity of that was very considerable. But that, of course, was at the time when the Hofmann violets were being displaced by the violets made directly by oxidising dimethyl aniline.

Total amount of alcoholic material used was not large.

35. Then, really the total number of gallons that were necessary for your purposes, either in the form of methylic alcohol, methyl iodide, or dimethyl aniline, was really not very large?—It was not very large.

36. Supposing you had manufactured all those things for yourselves on the premises, you would probably then not have used a very large number of gallons of the spirit?—No, not a very large number.

37. Possibly not exceeding 1,000 gallons?—I should not like to say that, speaking from memory, because I think we did get to use a very considerable number of tons of dimethyl aniline later on.

38. In dimethyl aniline is the proportion that the alcohol bears to the other constituents larger or smaller than in the methyl iodide?—The proportion of methylic alcohol to dimethyl aniline is very considerably more.

Quality of methylic alcohol used.

39. Where was the methylic alcohol that you used, either directly or in the form of methyl iodide, obtained; was it obtained in this country?—Yes, that was bought in London.

40. It was not a very pure spirit, was it?—No, it was the quality that was used for methylating.

41. In fact, it was so impure that it did not attract duty?—That is so.

42. And you paid no duty?—No. We had at one time some very fine samples which, I think, were described as potable alcohol sent to the works by Mr. Eschwege. I was very anxious to have them used, and I impressed upon Mr. Spiller the desirability of using them, because of their greater purity; but he said that he did not think it would be possible to obtain them, and as the ordinary materials gave very good results the matter was not further pressed. At that time there was no very urgent need for merely better processes.

43. I do not know that it very much matters, but in your *précis* you mention prices for methylic alcohol, which, as it was duty-free, seem rather high; how did it come to be as much as 20s. ?—I am afraid I have made a mistake there in saying that it was so high as that. I remember hearing the price of 16s. mentioned; but why it cost that I do not know. I had nothing whatever to do with the commercial side of the business at that time.

Ethyl derivatives were not preferable to methyl derivatives.

44. Then you say, "Ethyl derivatives of such substances as were manufactured by the firm had no advantage as compared with methyl derivatives." I suppose there are other articles the firm might have manufactured in which the ethyl derivatives would have been preferable to the methyl derivatives ?—No, not at that time. The ethyl violets were not so good as the methyl violets; they were redder in shade, that is to say, they were nearer the rosaniline in colour. Therefore, a triethyl rosaniline would not be so brilliant and so blue a violet as the trimethyl rosaniline. Then with regard to another colour in which ethyl appeared, which was ethyl green, there was little or no difference in shade; and even when diethyl aniline was made on the continent in some quantity and the ethyl green was put upon the market it never attracted much attention. There was not sufficient difference in shade between the ethyl derivatives and the methyl derivatives to make them important. As far as the violets were concerned the difference was against the ethyl derivative and in favour of the methyl derivative. In the case of the ethyl green I think there was a small difference which at one time attracted some attention; but it was very slight and did not last long; at any rate it was never a substance that could be described as an important one.

Relative proportions and relative cost of alcohol and iodine in making methyl iodide.

45. I understand that the methyl iodide was what you very largely used; would you give us, with reference to the extent with which the alcohol enters into it, some figures to show the proportion of the alcohol to the iodine ?—The iodine entered into it to the extent of rather over 89 per cent., and the methyl group, which constituted the rest of the molecule, would represent rather under half the weight in methyl alcohol. Therefore you might put it this way; that say 23 parts of methylic alcohol would give about 100 parts of methyl iodide.

46. Taking the effect of that upon the cost of production of the methyl iodide, what was the cost ?—The iodine was taken at a cost of 1s. per ounce.

47. How would the methyl iodide be reckoned ?—We used to reckon it by the ton.

48. You mention that out of the fifteen tons of methyl iodide which you used per annum, thirteen and a half tons would be iodine ?—Yes, that would be so.

49. The balance of that I take it would be attributable to alcohol ?—Yes.

50. In order to produce that fifteen tons, what number of gallons of methylic alcohol do you suppose would have been required ?—We should want about three tons of methylic alcohol, that is, 6,720 lbs, which, divided by eight would give about 840 gallons.

51. (*Mr. Tyrer.*) Of the ordinary methyl ?—Of the ordinary methyl alcohol.

52. (*Dr. Thorpe.*) Or more ?—Yes, it would be more, because there would be about 10 per cent. of impurity.

53. Then it would be one-tenth more ?—Yes, we ought to add on a tenth, which would make it 920 gallons.

54. (*Chairman.*) So that it would be roughly between 800 and 1,000 gallons ?—If you say about 1,000 gallons that would be very fair.

55. Could you give us some figures as to the comparative cost of the iodine and of the alcohol ?—If you take the iodine at 1s. an ounce, and the methylic alcohol at 30s. a gallon, that would make the cost of 100 ounces of methyl iodide 94s. 7d. Of that cost 89s. 4d. is the cost of the iodine and 5s. 3d. the cost of the alcohol.

56. There you are assuming that the alcohol paid duty ?—Yes. Now if you take 22s. off that 30s., and bring it back to 8s. per gallon, then the methyl iodide is 90s. 9d., and the cost of the alcohol in that case is 1s. 5d.

57. What is the price of iodine per ounce now ?—I cannot say.

58. Is it as much as 1s. per ounce do you think ?—I really do not know. It varies very much, but I should say not. Mr. Tyrer would know better than I do.

59. (*Mr. Tyrer.*) The price of iodine to-day is 9d.; it has just risen, within the last month ?—I will take that figure from you.

60. (*Chairman.*) Nowadays you would take the price of alcohol at considerably less than 8s. ?—Yes.

61. Would you say between 4s. and 5s. ?—Yes.

62. (*Dr. Thorpe.*) It would be less for that particular type of alcohol that they were using; it would be 2s. 9d. to-day, would it not ?—Yes.

63. (*Chairman.*) Would that be 2s. 9d. for the bulk gallon ?—Yes. The lowest price I can remember during the time I have been conversant with prices was 6s. per gallon. That was about the year 1895. We used to get our supplies from a very old London firm.

64. (*Mr. Tyrer.*) Were you stating the price of ordinary wood naphtha for methylating in 1895 ?—Yes. My recollection is that 6s. is the lowest price that I remember to have heard that was commercially paid for it.

65. And that was about the year 1895 ?—Yes. That was the price which I had to use in calculating out costs.

66. The same quality that is used for methylating ?—Yes.

67. About 1895 I think it was 4s. 6d., and to-day it is from 3s. 3d. to 3s. 6d., according to the quantity ?—I will take that from you.

High selling price of dyes in 1871 to 1875 as compared with present prices.

68. (*Chairman.*) As to the price at which the dye was sold, you say in your *précis* that the average selling price was about 40s. per lb ?—Yes, but that is rather too high. At the time I prepared that *précis* I was endeavouring from various sources to get some authentic information, and I could not get any; but since then I have succeeded in getting from a firm who were the agents of Messrs. Brooke, Simpson & Spiller in Glasgow, the prices for 66 per cent. violets in the years 1871-1875. You will find that this figure, if it is taken as an average over the whole quantity, will not be very far out. Take the Eclipse violet solution. That represented the trimethyl which was the highest methylated product; there were between two and three ounces of that in a gallon of methylated spirit when the selling price was 24s. per gallon. Then take the Hofmann violet crystals, which was a 66 per cent. article, the rest of it being dextrine. These methylated violets will not form a solid mass, and they had to be mixed with something which would form them into a hard mass if they were to be sold as what were termed crystals. They were not really crystals, but they were flakes. The Hofmann crystals are put down at 23s. 6d. per lb. Then there was the 3B, which almost corresponded to the Eclipse, but it was just a little redder; that was 27s. 6d. per lb. The 2B was 24s. 6d. per lb. Then in 1875 the Eclipse violet was 25s., the Hofmann crystals 18s. per lb., and the 3B 24s. per lb. At the same date what are called the Hofmann violet crystals were 23s. per lb. Practically, therefore, the prices were little changed between the years 1871 and 1875. The prices which I have given you, except in the case of this solution—and they have only given me the price of one solution—are for a solid dye, containing about 66 per cent. of true pure colouring matter.

69. Are the selling prices of those same dyes that you have mentioned very much lower at the present moment ?—At the present moment these Hofmann violets are obsolete. There would be a few people who would pay for them if they could get them, and they would not be much influenced by the question of price. The dyes derived by the direct oxidation of alkylated aniline, that is to say of dimethyl aniline, are enormously cheaper. For instance, I believe you could buy 100 per cent. 3B violet, which corresponds to the highest degree of methylation, for about 1s. 8d. per lb. In the same way the magenta crystals which I have spoken about as selling at £3 an ounce are to be bought to-day for about 1s. 10d. per lb.

Quantity of alcohol used in producing a pound of highly-methylated dyestuff (rosaniline).

70. Taking those two, what quantity of alcohol would be used in producing a pound of the finished dye stuff ?—It would take some time to work that out, but there are data in my *précis* which would enable one to get at that.

Mr. R. J. Friswell.

8 Nov. 1904.

In the most highly methylated rosaniline—that is, the Eclipse violet—319 parts of rosaniline base were combined with 45 parts of methyl, or 96 parts of methyl alcohol, or 426 parts of methyl iodide ; therefore you get 316 plus 45, which equals 361 lbs. That would take 60 lbs. of true acetic acid, which would mean 421 lbs., and there would be possibly 20 per cent. of water when that dried down. That would mean 500 lbs. of the 100 per cent. dye, and then that would be reduced to the 66 per cent. That would be about 759 parts of it, and therefore in 750 lbs. there would be used about 96 lbs. of methyl alcohol.

71. Or about 12 gallons in 750 lbs. ?—Yes, in, say, 750 lbs. of the finished dye.

72. That is 1 gallon to about 63 lbs.—in fact, it is the 63rd part of a gallon for each lb. ?—Yes.

73. And that on an article which sells, at one price you gave of 1s. 10d. per lb., and at the other of 1s. 8d., as I understand ?—No. Those are the violets derived from dimethyl aniline, and I am speaking of violets produced by the Hofmann process.

74. Take the highly methylated rosaniline prepared by Hofmann's process, what would that sell at now, do you suppose ?—I should think that anyone who really wanted it could not get it for any less possibly than the prices that I have mentioned in my *précis*, or something near them.

75. (*Mr. Scott-Montagu.*) It has been practically superseded, has it not ?—That dye has been superseded and has become obsolete. I may mention that a few of these colours used still to be made, and that they were used for biological purposes—that is, for staining. For instance, I prepared a large quantity of the true crystalline iodine green which had never been obtained before in a crystalline form, but there was no market for it, and the whole quantity that I prepared was gradually sold to people who used it for staining.

Difference in cost of production with duty-paid and duty-free alcohol.

76. What I rather wanted to get at was this : we have an article sold at, say, 1s. 10d. per lb., and what we have to consider is what obstacles have been placed in the way of the manufacture of that article in this country by the difficulty of obtaining alcohol at a moderate price. Now, to form an idea as to that, I should like to know what on each pound would be the difference in the cost of production of that pound if the alcohol cost 1s. per gallon or if it cost 20s. per gallon ?—I will prepare those figures for you ; I should not like to undertake to do it now.

Quantity of alcohol used in making dimethyl aniline and its derivatives.

77. It makes an enormous difference what the quantity of alcohol is that enters into the pound of the finished article ? —You are, of course, alluding to those violets which are now sold. Take those, for instance, which are prepared from dimethyl aniline. In the case of dimethyl aniline you would use an amount of methyl alcohol almost equal to the weight of the aniline and the weight of the violet obtained is almost the same as the weight of the dimethyl aniline employed. It appears in the form of hydrochloride and the addition of the weight of the chlorine molecule to it makes up for the very small loss there is in dimethyl aniline, because the condensation which can be brought about in dimethyl aniline is practically a net one, a quantitative one, and there is no loss, no by-product being formed. There are practically no by-products in producing the trimethylrosaniline form The methyl groups are put into the rosaniline group, and they remain there, and you have got the exact quantity that you expected to get.

78. (*Mr. Tyrer.*) Might I suggest that if you are going into calculations, it would be quite as well to be as near as possible in your figures to what we are to-day, and that it might be helpful to get two rather precise data, one the actual price, or at any rate what is said to be approximately the actual price of the spirit in Germany to-day, and the other the price of the spirit to-day to the British manufacturer ?—Yes.

79. (*Chairman.*) I suppose alcohol enters in very varying proportions in the different articles ; therefore we might take a highly methylated one and one that is not so highly methylated ?—I think we can say this—that if you took 93lbs. of aniline, that would require 64lbs. of 100 per cent. methyl alcohol to convert it into dimethyl aniline, and the dimethyl aniline would weigh 121lbs. You would require 64lbs., or roughly 8 gallons of 100 per cent.—that is to say pure—methyl alcohol.

Tax on alcohol not a material factor in the decay of aniline dye industry in the United Kingdom. (*See* also Qs. 14–21.)

80. (*Mr. Scott-Montagu.*) Do you consider that the tax which aniline dye manufacturers have had to pay on alcohol has damaged their trade in any way as compared with the trade in foreign countries ?—No, I do not think so.

81. You do not think that is a material factor ?—No, certainly not.

82. Not in view of the fact that the aniline dye trades have largely passed, I am sorry to say, to Germany ?—No, certainly that is not a material factor. The cause of the disappearance of those trades from this country is quite another cause.

Smaller relative importance of alcohol now in production of colours. (*Vide* also Qs. 6–7.)

83. (*Mr. Tyrer.*) Surely with your experience of the enormous trade which is described as employing many thousands of men on the Continent, and the statements in such papers as are devoted to the spirit industry, giving some idea of the allocation, so to speak, or the distribution of alcohol for various purposes, the least of which, although by no means insignificant, according to recent statistics, appears to be devoted to the colouring industry —surely you would say that would make a vast difference here ?—I cannot think that any such difference would in the least have affected the industry at the time when it began to pass away from this country. I do not think that the amount of alcohol used in the aniline dye industry to-day has anything like the importance that it had in the early days of the industry. The relative production of the azo colours is so enormous, and there are so many other colours now in which there is no necessity for the use of alcohol at all, that I think those in which alcohol is used are a small percentage compared with what they once were. When the industry began, practically all the colours used alcohol, that is to say, they used methylated spirits. For the purposes of crystallising I do not think that there would have been any particular advantage gained by using pure methylic alcohol or potable methylic alcohol in place of methylated spirits. When it comes to the development that has taken place in the direction of some pharmaceutical products or therapeutic products, which have arisen out of the aniline dye industry, then possibly the difference would have been considerable between the possibility of obtaining alcohol duty free and not duty free. But as regards the colours themselves at the time when the industry, we may say, was defeated or driven from this country, the matter was not important ; the prices obtained for the dyes were very high and the quantities of alcohol required to produce them were very small relatively.

On the other hand certain dye cannot be made profitably without duty-free ethyl alcohol —*e.g.*, rhodamine.

84. (*Mr. Scott-Montagu.*) In your *précis* I notice you say, "In conclusion, I would venture to suggest to the Committee that there are undoubtedly cases in which the use of duty paid alcohol would render a manufacture unprofitable or even impossible," and you go on to give particulars. Notwithstanding what you have already said to Mr. Tyrer and myself I understand that you still admit that there are industries in which the use of free alcohol is important ?—Undoubtedly ; I do not think that can be denied.

85. In the dye trade ?—There are certain dyes in which the use of ethyl alcohol is a matter of importance. I have given an instance of that in the case of rhodamine in which the amount of ethyl alcohol employed is 45 per cent. of the weight of the finished chemical product.

86. Is that a product which is much used ?—Not to a very great extent, and it is a very high priced article.

87. For instance, can our competitors the German chemical industry make that cheaper than ourselves ?—Certainly they can.

88. In consequence of the disadvantage of the duty that we labour under ?—Certainly. We could not make that rhodamine 3B as cheaply as it can be made with duty free alcohol, because ethyl alcohol has to be used for its manufacture.

89. (*Chairman.*) And it has to be pure ?—Yes.

Possibility of denaturants *ad hoc* for spirits so used.

90. (*Mr. Tyrer.*) Would you say that it has to be absolutely pure and in no sense de-natured ?—It would be denatured by the addition of the substance which converts

(*See* also Qs. 120-2&130-1).

it ultimately into methyl chloride, for instance, by dissolving in it chloride of zinc or passing into it hydrochloric acid gas.

91. The use of the zinc chloride or of hydrochloric acid gas would render it distinctly unpotable, would it not?—Certainly.

92. (*Mr. Nicholson.*) When you speak of pure alcohol are we to understand you to mean rectified alcohol?—I mean alcohol free from water—practically 99 or 99½ per cent.

93. (*Dr. Thorpe.*) Do you also mean a pure alcohol in the sense that it is not methylated?—Certainly.

94. (*Mr. Tyrer.*) It is an important fact, is it not, that the introduction of zinc chloride would render it unpotable?—Yes.

95. That would be a form of de-naturing which would not interfere with the manufacture, would it?—No. In all these cases I take it that de-naturing could be accomplished in the presence of an Excise officer. Supposing he saw the alcohol put into the autoclave with the dye and the other materials used, and the autoclave were closed when it started, I fancy that he would be satisfied without anything further than that. I understand that at one time the department did permit some dutiable methyl alcohol to be used in the manufacture of dimethyl aniline. An attempt was made to manufacture that in this country, but it did not prove commercially profitable and it was abandoned. There is another question which arises, and that is the competition of methyl and ethyl products derived from the methylamine and ethylamine, which are the products of the destructive distillation of beetroot residues—vinasse they are called—which are obtained in the manufacture of beet sugar. At one time, at any rate, you could buy ethyl chloride and methyl chloride in copper cylinders. In France they were manufactured in that way, and I am informed that they have been very largely used in the manufacture of dimethyl aniline, diethyl aniline, and so on. In that case I doubt whether fermentation alcohol even without the duty would have enabled us to compete.

Vinasse a source of cheap ethyl and methyl products in France, etc.

96. (*Chairman.*) Is the stuff produced from the beetroot, the vinasse, an alcoholic material?—It first appears in the form of a compound of a radical of the alcohol in the form of a methylamine and so on, and that is converted into the chloride of the alcohol radical, that is to say, you would take roughly from methyl alcohol about half its weight, and combine it with chlorine, and you would get a weight of chloride of methyl which would be rather more than a third, say one half, greater than the weight of the methyl alcohol, in which it would be in the form of a chloride instead of the hydrate. That would not be potable, of course.

97. (*Mr. Tyrer.*) That resolves itself into the utilisation of a by-product, and perhaps germane to that question is this: Is the amount of vinasse produced sufficient to provide all, or any considerable part, of the alcohol required in industries to which it is applicable?—I cannot say accurately, but the quantity must be something gigantic with the universal distribution of the beet sugar industry all over France, Belgium, Austria, Germany, Russia, and elsewhere.

Dyes which require pure alcohol a small proportion only of the whole.

98. (*Chairman.*) Am I right in understanding that your view is this: Taking the aniline dye industry as a whole, first of all there is a considerable number of dyes that do not require alcohol for their manufacture at all?—That is so.

99. Next, there are a large quantity which, while they require alcohol, do not require pure alcohol?—That is so.

100. For which the methylated spirit is quite sufficiently good?—Yes.

101. Then there is, finally, a comparatively small fraction of the whole in respect of which pure spirit is more or less necessary?—Yes, that is so.

Alcohol for motors.

102. In the last sentence in your *prècis* you say, "Alcohol for motors could be denatured as effectively as methylated spirit now is by the use of less costly denaturants than wood naphtha." That is a very interesting point, but it is rather going away from the particular matter that we have asked you to come here about. Perhaps, however, you would tell us very shortly what your ideas are on the subject?—Very shortly this question of the use of alcohol in motors has come before me professionally, and before it did so I was also interested in motors through friends of mine who owned them, and I had had some experiments tried with the use of benzene and toluene and things of that kind obtained from coal tar. A mixture of benzene and toluene particularly can be obtained now in any quantity under the name of 90 per cent. benzol at about 9d. or 9½d. per gallon; sometimes it is less than that, and I have known it to be as low as 4d. and 4½d. per gallon. That could be mixed with alcohol. It would be cheaper than I believed the methyl alcohol to be, but I understand from what I have heard to-day that I have rather put too high a price upon the wood naphtha used for making methylated spirit. Still, this can be got for about 9d. or 9½d. per gallon, and that is considerably cheaper I think than the lowest price that has been mentioned for wood spirit.

Benzol a cheaper denaturant than wood spirit, and not easy to separate from the alcohol, (*See* also Qs. 123 to 125).

103. Could not the spirit so denatured be comparatively easily purified?—I think it would require some considerable amount of chemical skill to separate it.

104. Would it mean any great expense supposing it was done on a large scale?—It would take very complicated distilling apparatus. It could not be done without the use of a very large rectifying column, such as is used with the Savalle still which we use for purifying benzene. That column is generally about 27 feet high, and has 30 to 40 trays of perforated copper in it for the vapours to pass through. I do not think you can separate it very easily.

105. (*Mr. Scott-Montagu.*) You do not think there would be much chance of a fraud on the revenue from that point of view, do you?—No, I do not think so. I think possibly it might be made a little more difficult by the addition of some other body; perhaps of aniline in small quantities.

Especially with small quantity of aniline added.

106. (*Sir William Crookes.*) Do you remember the price of petrol per gallon?—I think it is about 1s. 4d. per gallon.

107. Then this would be decidedly cheaper, but would it be as good?—I have heard that very good results have been obtained with the alcohol, but I cannot speak from experience.

108. (*Mr. Tyrer.*) In the paper on "The Need of Duty-Free Spirit for Industrial Purposes" which I read on April 27, 1904, there is, on page 515 of The Journal of the Society of Arts (No. 2684), a table prepared by Mr. Leuthardt-Thornton showing the spirits used per £100 imported value, and among a long list of products given are the rhodamines. I think it would be most interesting and useful if you would be good enough to critically examine that table. Taken in connection with your very deliberate statement that the price of alcohol has comparatively little to do with the decay of the industry here—which is a very important statement, and is contrary to the public notion, which I confess I hold—it would be extremely desirable if you would criticise these figures, which are said to be authentic?—Certainly; I will look into that table.

Quantity of spirits used per £100 value of imported dye-stuffs.

109. (*Sir William Crookes.*) There is one point that struck me at first when you were speaking about the manufacture of magenta and crystallising it from water; the magenta then was made with arsenic, was it not?—Yes.

Possible physiological effects of arsenic used in manufacture of dyes. (*See* Q. 11.)

110. There was a great outcry about the presence of arsenic, and I believe there were many cases of poisoning owing to the presence of arsenic in the magenta and dyes derived from it. If that magenta had been crystallised from alcohol would there have been any arsenic in it?—Yes, because arsenic had been detected even in the phenylated colours—the blues. But with regard to that outcry to which you allude, I fancy that arsenic was simply a popular name given to it. There were certain dyes which produced irritation and the irritation was said to be caused by arsenic. Now, one of the worst offenders, in fact by far the worst offender, was a dye known as aniline orange which was a-hexanitrodiphenylamine; that was obtained by treating the low grade triphenyl rosaniline blues with nitric acid. That was absolutely free from arsenic, it contained no arsenic at all, and none had ever been used except in the rosaniline which was a very long way back. That had been phenylated, then it had been crystallised from alcohol, then the

Mr. R. J. Friswell.

8 Nov. 1904.

whole of that alcohol had been recovered, and then that body had been acted upon with increasing intensities of nitric acid until the whole of it had been converted into the orange by putting in those nitro groups. By that time, therefore, there was absolutely no trace of arsenic left; and yet that produced the most virulent and frightful irritation. It has been very largely used by leather-dyers for dyeing saddles and so on because of its special properties, and is to this day; but in many cases the people who use it as a dye have to work with indiarubber gloves on on that account.

111. I have no doubt that arsenic got the blame of a great deal that it did not deserve, but at that time I had something to do with these matters, and I detected arsenic constantly in different dyes—in some cases in more than minute traces—indeed in quantities quite sufficient to produce physiological effects?—I do not think the acetate of rosaniline would have crystallised from alcohol. It forms a dense syrupy liquid which does not crystallise. The hydro-chloride of rosaniline which succeeded it later could have been crystallised from alcohol, but the crystals would still have been largely contaminated with arsenic.

Importation of dimethyl aniline (*see* Q. 33) not due to duty on alcohol but to the difficulty of manufacturing this substance. (*Vide* also Q. 1434.)

112. (*Dr. Thorpe.*) You told us that your firm invariably imported dimethyl aniline?—Yes, that is so.

113. Although there was no fiscal restriction on the use of such methyl alcohol as might be needed to make dimethyl aniline?—Quite so.

114. You imported it, too, at a time when its extraction from vinasse was not a commercial fact?—That would be so, because I do not think we imported it before 1886.

115. Was the use of vinasse—that is to say, the distillation of vinasse to make methylene products—before or subsequent to that date?—It was very near to that date, because it was about that time we also imported this methyl chloride from France.

116. Do you think you imported dimethyl aniline because, on account of the vinasse distillation, you got it cheaper?—I think so. I know it was sold at prices which were slightly above the price of pure aniline in this country.

117. You could have made dimethyl aniline sufficiently good for your purpose from the kind of methyl alcohol used for denaturing, could you not?—Yes, we could have heated in an autoclave aniline hydrochloride and methyl alcohol.

118. Such methyl alcohol as is good enough for denaturing—in other words, duty free methyl alcohol?—Yes.

119. The question, therefore, of the duty did not enter into the question of the manufacture?—No, the trouble in the manufacture of dimethyl aniline is the separation. You get a mixture of aniline, mono-methyl aniline and dimethyl aniline, and I believe under certain circumstances toluidines, are formed by Hofman's reaction, causing an interchange. The difficulty is to distil and separate these bodies, and to get the really pure dimethyl aniline, because if you do not get a very high quality of dimethyl aniline the production of the violets is bad—that is to say, the shade is red and not sufficieutly blue.

Addition of denaturants under Excise supervision. (*See* Qs. 90, and 130–1.)

120. You gave as an illustration the use of certain materials—zinc chloride and hydrochloric acid you mentioned—things which are themselves ancillary to the manufacture and which might be used as denaturants?—Yes.

121. But you also said that they would require to be added under Excise supervision?—I did not mean, perhaps, to say that. I meant that those things should be added at the works where the alcohol is to be used and that an officer would probably attend to see that done. It did not occur to me that at any rate the hydrochloric acid and the zinc chloride might have been added, and then it could have been sent to the works; I did not think of that at the time.

122. I ventured to imagine that what you meant to imply was that the addition of any denaturants of that order would, in the interests of the revenue, have to be safeguarded by the presence of a Revenue officer?—Certainly it would if it was done in the works where the substance was to be used.

Alcohol for motors.

123. With respect to your suggestion as to the use of a mixture of benzene or what is called 90 per cent. benzol, to alcohol for motor purposes, would not the mere addition of water cause the whole of that denaturant to be separated?—No, the alcohol would still retain a very strong smell of the mixed benzene and toluene, and I should have said xylene also, which occurs in that 90 per cent. stuff. I should doubt very much whether anybody would drink it, and I think, if they did drink it, it would produce very serious effects, even after washing with water.

Possibility of purifying spirit denatured with benzol (*See* Q. 102.)

124. If one took such diluted spirit—that is to say, the spirit to which you had added a certain quantity of water in order to throw out these hydrocarbons—cannot you, as a chemist, suggest some method short of distillation by which that spirit might be so freed as to make it possibly potable—I do not ask you to say that it would be?—I think possibly that by shaking it with sulphuric acid one might succeed in dissolving out the last traces of the benzol. Benzol, and toluol especially, are easily attacked by strong sulphuric acid.

125. What I want to know is whether the Revenue would be safeguarded and whether it is possible to so treat that mixture of spirit and alcohol as to make it possibly potable?—I think it would be possible, but I think it would be a long and expensive process. The small traces of toluol, benzol, and xylol, and so on, stick most obstinately to the spirit. It is most difficult to free them. Aniline is another case in point; it is most curious to see the difficulty there is in freeing spirit from it. We had very great experience of that, because we were always recovering the methylated spirit used in crystallising the triphenyl-rosaniline, and practically unless we put it through a big Savalle still, I do not think we ever took the small trace of aniline away from it.

Real cause of the decadence of the coal-tar dye industry in the United Kingdom. (*See* ante Q. 14–21, 80–82.)

126. The last point I wish to put to you is of a general nature. You led the Committee to believe that in your opinion alcohol has had very little to do with the position of the coal-tar dye industry in this country?—Yes, that is so.

127. You have had, you have told us, some 25 years' experience in connection with the industry, and you have practically, during that time, seen its rise and fall in this country?—Yes.

Lack of scientific spirit on part of manufacturers.

128. What, in your opinion, is the real cause of the decadence of the coal-tar dye industry in this country?—The real cause was that those who had the financial power and control of the business had no appreciation of the fact that the science of chemistry, which had originated the business, could continually develop it in a great number of directions which were quite unforeseen when the industry was originally started. They looked upon all these discoveries as isolated, and not connected in any way, and they thought that they were discovered by lucky flukes. They, therefore, never employed a staff which was continually engaged upon research. At the time when I entered the firm of Brooke, Simpson & Spiller, the only chemist there except myself was Mr. John Spiller, Mr. William Spiller's brother. For some time we were the only two chemists, although that firm, I believe, was then the largest aniline dye industry in existence. We had only one laboratory; later Professor Meldola—Mr. Meldola as he then was—was appointed and a laboratory built for him. Then, when that was done, his discoveries were never appreciated by those at the head of the affair. They had an idea that unless the colour could be sold at such profit that all the plant erected for it could be paid for in the course of a year or two, it was folly to do anything of the kind. I can give an instance of that. I discovered a few days ago a memorandum that I had made in 1876. At that time eosine had been discovered, I think two years previously, or at least it had been placed upon the market, by Caro, in 1874. We were very anxious to find out what eosine was. It was discovered, and in 1876 I succeeded in making it. I made 10½ lbs., the memorandum states, and it cost 12s. per lb. to make, paying 2s. 6d. per lb. for the bromine and 1s. 6d. per lb. for the acetic acid that was used in the dye, the other materials being benzene, sulphuric acid, and caustic soda for making resorcin, and naphthalene for making phthalic anhydride. I set these details before the firm and asked it to allow the manufacture to be carried on. The eosine then was selling at 20s. per lb., and there was a sufficient margin between the cost of manufacture and that price. The permission was refused.

The case of eosine.

129. Was eosine never commercially made in this country?—Yes, later on, when I became director, we made very large quantities, but by that time we were obliged to buy resorcin and phthalic anhydride, because for all these years the manufacture of those articles had been neglected, and it was practice in making those things which enabled them to be made cheaply at last.

Denaturants (*See* Qs. 90 and 120–2).

130. (*Mr. Tyrer.*) With regard to the chloride of zinc, supposing you had permission to denature under the regulations on the premises, without adding chloride of zinc or other denaturing agent at the time of the operation, would it not be possible to prepare a large bulk of, say, 5,000 or 6,000 gallons at a time?—Yes, certainly; I do not think there would be any trouble in that.

131. My question relates to the possibility in transit of some tampering, which might under certain circumstances be conceivable, but might, nevertheless, be more or less difficult. You have given us an instance of the removal of the hydro-carbons by sulphuric acid, but I fancy the attempt to remove this diluted spirit, this separated hydro-carbon spirit, would be a task which would lead to very speedy discovery?—There is one point about the use of chloride of zinc, that of course it could be very easily got out of alcohol, but I do not see how that could be done, unless it were done in the works. There could be no trouble whatever in removing it.

Little risk of misuse of spirit by workmen in making dyes.

132. (*Chairman.*) Is the process of manufacture in connection with these dyes such that the individual workman would be brought much in contact with the spirit that is used?—Do you mean in methylating, for instance?

133. Assuming that you are allowed to use a perfectly pure, duty-free spirit; for your own protection in certain forms of manufacture, you would have to take very great precautions to prevent the workmen from drinking it, would you not?—Yes.

134. In this particular manufacture that we have been talking about, would many individual workmen have many opportunities of getting at the spirit?—No, not in a properly controlled factory. Take the case of the preparation of those Hofmann violets. Supposing we had used pure methylic alcohol, or potable alcohol, there was only one man who absolutely had the control of the introduction of the alcohol to the phosphorus, and after that the matter was over. The way it was made was this—simply that a large quantity of iodine, the necessary quantity of iodine, was dissolved in the alcohol, and then that was run in a stream into a still provided with an agitator and containing vitreous phosphorus. The methyl alcohol and iodine went in a continuous stream into this, and the methyl iodide came out of the condenser in a continuous stream, when it was no longer methyl alcohol and nobody could drink it—certainly nobody could drink it when it had got the iodine mixed with it. The control of that would have been perfectly simple.

135. Even if the spirit as used in that manufacture was perfectly pure, the controlling of it would not be a very difficult matter?—No, not at all. Where autoclaves are used, as soon as the autoclave is closed and heated, no man would dare to open it if he had the power, and when the heating is over, and the thing is cold, the alcohol has disappeared—it is no longer alcohol.

Duty free spirit essential for manufactures requiring ethyl alcohol.

136. (*Sir W. H. Holland.*) I understand that you have admitted that some branches of manufacture which required pure alcohol were rendered impossible by the present regulations, and had to be abandoned, and employment was *pro tanto* limited?—Yes, I should say so. Wherever ethyl alcohol must be used there is, I should say, no industry of any kind sufficiently profitable to justify the payment of the duty.

137. Therefore, such industries are perforce transferred to foreign countries?—If there are any such industries they must necessarily be carried on elsewhere.

138. And employment here is *pro tanto* limited?—Yes. I have carefully read the French regulations, and it appears to me that they provide, in nearly every case, for the denaturing of the alcohol in some form or another in the presence of an officer of the *Contributions Indirectes*. I presume that something of that sort might be permitted here.

Dr. Herbert Levinstein, M.Sc., called; and Examined.

Dr. H. Levinstein, M.Sc.

139. (*Chairman.*) I understand you are a member of the firm of Levinstein, Limited, of Manchester, manufacturers of coal-tar dye-stuffs and coal-tar products?—We are manufacturers of coal-tar dye-stuffs.

140. Has that firm been in existence for a long time?—It has been established since 1864.

141. It was, in fact, one of the earliest in the business?—Yes, it was one of the earliest manufactories established here.

142. Are you the chemist to it?—At present my father, whom I really represent here to-day, is the managing director, and when he is away I look after it, and am responsible for the conduct of the business.

143. Have you any considerable staff of chemists?—I could not exactly say how many, but I should think we have about twenty who are men with university degrees and men of university standing, either abroad or here.

Organic Chemical industries in the United Kingdom handicapped by high price of alcohol.

144. In the *précis* of your evidence, you say that you propose to take it first under the head of "The organic chemical industries stifled by the heavy duty and the high price of alcohol through this and other causes"; and then you go on to say that industries resting on the application of organic chemistry have never found a foot-hold in this country, "largely owing to the heavy duty imposed on pure alcohol." That may be true now, but is it quite true of the past?—Practically speaking, it is so. What I meant by that paragraph was, not that it was entirely owing to the high duty upon pure alcohol, but that it was owing to the high price of alcohol, whether methylated or pure; and I think that is correct.

145. I was referring rather to the expression that it has "never found a foot-hold in this country." After all, the industry originated in this country, did it not?—It originated in this country, certainly, but the development which it reached in this country at its best and at its greatest cannot be compared with the development which it has since reached in Germany. The point that I wished to emphasise was that between 1850 and 1860 coal tar was first separated into a great number of substances which have since, many of them, turned out to be of great commercial value, as the raw products for a great number of separate and distinct industries, which I think one can say represent to a large extent the organic chemical industries in Germany. Large research staffs were established by the German colour works, working on those industries and developing them to an enormous extent. I maintain that that could not have been done in this country, and was not done in this country for several reasons, one of which is the high price of alcohol.

146. You would not attribute more than a part of this great change to the high price of alcohol, would you?—I maintain that it was impossible for us to obtain the same development here from a number of causes. Supposing alcohol had been as cheap here as it was in Germany, I still think it would have been impossible for us to have obtained the same development. I think that by itself the high duty on alcohol was sufficient to stop us. I think there were one or two other causes which also rendered it difficult for us in this country to build up an industry like the Germans did. Certainly the duty on alcohol by itself was perfectly sufficient, and I presume you are not interested in any other question except the duty on alcohol?

147. No, we have got to confine ourselves to that here.—That of itself I think was perfectly sufficient to prevent it.

Dr. H. Levinstein, M.Sc.

8 Nov. 1904.

148. When was that first realised? Take, for instance, the experience of your own firm; when did your firm begin to realise that fact?—I am afraid it was a good long time before my time when they first began to realise it. I should say thirty years ago.

Alcohol question not of importance in the early days of the aniline dye industry, when profits were large.

149. The industry was exceptionally prosperous in the sixties, was it not?—Yes, it was very prosperous in the sixties and the seventies.

150. During that time, at any rate, the difficulties in regard to the alcohol did not affect it?—No, because at that time there were comparatively few colours made from comparatively simple materials and sold at a very large profit.

151. But alcohol entered largely into the formation and the preparation of those colours, did it not?—To some extent. Profits were enormous, and the price of alcohol was consequently a matter of small moment. As the profits on dye stuffs became less the cost of alcohol became prohibitory, and the manufacture ceased.

Cheap Alcohol essential now, but would not give immediate impetus to the industry in this country.

152. Should you say then that alcohol in later years has entered to a larger extent into the preparation of the dye-stuffs than it did in the earlier years?—Certainly, since the number of alkylated dye stuffs has immensely increased and the quantities produced are very much greater.

153. As regards the spirit that was used, it was not a pure spirit, was it?—No; I think that in those days the small amount of spirit used, but I would not be quite certain of it, probably was crude spirit. It was practically of no importance whatever in those days.

154. Then you consider, at any rate, whatever may have been the case in the earlier days of the industry, that cheap alcohol now is essential to the successful prosecution of it?—Absolutely. I am far from thinking that if the alcohol was as cheap here now as it is in Germany the industry would all of a sudden take an enormous step upwards. The time has passed for that. You cannot by a stroke of a pen establish an industry.

155. (*Mr. Tyrer.*) But it would take a turn, would it not?—It would certainly be of considerable assistance to people who are established. It would lead to the opening of new branches of industry.

156. (*Mr. Scott-Montagu.*) The fact is, we have suffered in the past, and it will take us a long time to regain the same power of competition that we had?—Yes, certainly it will.

Price of methylated spirit prohibitive in face of competition with Germany.

157. (*Chairman.*) In its flourishing days it used largely, as you say, methylated spirit, and there is still a large proportion of these dye-stuffs that can be made with methylated spirit, is there not?—I should say that none could be.

158. None?—No, not with the present price of methylated spirit.

159. Then, would you hold that the difference in price between methylated spirit and pure spirit is in itself sufficient to form a great handicap on the trade?—No. What I meant to say was that competition is so severe with the German dyes, that we could not afford to use even methylated spirit, because methylated spirits in this country are far dearer than the pure spirit is in Germany.

160. (*Mr. Tyrer.*) That is strength for strength?—Yes.

161. (*Chairman.*) What do you do now?—We do not use either methylated spirit or pure spirit.

162. Then, in fact, you do not use alcohol?—We do not use alcohol at all.

163. Not for any purpose?—Not for any purpose. If there is any product which comes into our hands or is discovered in our laboratories, for which alcohol would be necessary, we veto it, and we do not touch it.

Intermediate products requiring alcohol must be imported. (*See* Q. 205–16.)

164. Then the intermediate products which you speak of further on, which require alcohol for their preparation, you would have to purchase?—A few of them we can purchase, most of them we cannot.

165. You mean they are not to be bought?—They are not to be bought. They are made by our competitors, and they will not sell them.

166. Further on you mention certain colours, such as Victoria blue, rhodamine, formyl violet, and so on. Do you now prepare all those?—No, we do not make any of them, and we cannot. I just took them as a few typical examples.

Examples of colours requiring alcohol which cannot be made by witness' firm.

167. All of those are beyond your reach?—They are absolutely beyond our reach.

168. (*Mr. Scott-Montagu.*) From what point of view?—Because alcohol is used in their preparation, either in the intermediate stage or in the finished dye stage.

169. Do you give us a list of those which you say are beyond your reach?—It is hardly a list, but I give a few examples. That list could be made indefinitely longer.

170. It could be extended, of course?—I should think there are 300 or 400 dyes on the market.

171. (*Chairman.*) Have you tried to take any advantage of the section in the Finance Act of 1902?—No, we have not.

Other developments of coal-tar industries abroad.

172. In the early part of your *précis* you say, "The foreign colour works are together enormous manufacturers of photographic chemicals, synthetic perfumes, drugs, and pharmaceutical products, mostly derived from coal tar. Pure alcohol is used in the preparation of nearly all these products, which cannot be made here." Pure alcohol is absolutely necessary in many of those things, is it?—I think it is necessary for the few I have mentioned.

173. Does alcohol enter into the manufacture of these preparations, such as antipyrin, phenacetin, etc.?—Yes.

174. Do you do anything in the direction of drugs and pharmaceutical products?—No, we do not, but our competitors in Germany do. We have been debarred from that by the duty on alcohol. They are made from coal tar, so that practically the raw material we both use in common, only they have been able to develop it on quite different lines to those we have.

Price of alcohol in England and Germany compared.

175. Then you give figures as regards the quantity of alcohol employed in German colour works, and you compare the price of alcohol in this country with the price of alcohol in Germany, you say, "Duty-paid pure ethyl alcohol costs £1 1s. 6d. per gallon in this country"—that is, of course, duty-paid and of high strength?—Yes.

176. "In Germany about 10d."; is it 10d. the bulk gallon of that high strength?—I believe so.

177. Have you any personal knowledge of the German spirit prices?—They vary; there is a ring in Germany, and I am not sure what is at present the market price in Germany; but I think the figure I have given is approximately correct.

Diethyl aniline.

178. In the next sentence you say, "The cost of manufacturing one pound of diethyl aniline from duty-free alcohol is about 5½d."; is that 5½d. the price of the alcohol in the one pound, or is it the price of the one pound?—That is the price of one pound of diethyl aniline.

179. It can be bought at 5½d.?—It can be made at 5½d., and bought at a little more than that.

180. What amount of alcohol would enter into that pound, do you suppose?—I am not prepared to say offhand, but I should think it would be about half and half. I could easily work it out for you.

181. In the diethyl aniline, the alcohol, I believe, is incorporated into the aniline, and cannot be recovered?—It is a matter of great difficulty to recover it.

182. Therefore, in this country, if the manufacture of diethyl aniline was started, and if people wished to use pure spirit, there would be no very great difficulty in allowing duty-free spirit provided there was sufficient control exercised over that particular manufacture?—No, there would be no difficulty whatever.

Prohibitive effect of a difference of 6d. a gallon.

183. Then, supposing the price in Germany for that sort of duty-free spirit is 10d., and the price in England is more—because there are circumstances, I think, which tend to make the spirit in Germany unduly low—it is not quite a true price, I fancy?—That is so.

184. Supposing there was a difference of as much as 6d., making it 1s. 4d. here, would that be a sufficient difference to make the manufacture of diethyl aniline in this country difficult or impossible?—I think it would prevent it.

185. It would?—I think so. The profit on these things is so small that, speaking for ourselves, we certainly would not start making it under those conditions. If we had to pay 6d. more we would prefer to do without it, or to buy it.

186. (*Mr. Tyrer.*) I presume that in speaking of gallons you speak of bulk gallons, and not of proof?—Yes.

Methylated spirit suitable as a solvent.

187. (*Chairman.*) Then you go on to the methods in which pure alcohol is employed in the manufacture of coal tar dye stuffs, either as a solvent or for the production of methylated or ethylated, in other words, alkylated dye stuffs; in which of those two branches is the larger quantity used?—In the latter.

188. For the former as a solvent, surely methylated spirit is not unsuitable?—No; methylated spirit is quite suitable.

189. Only, there again, you come to the high price?—Yes. In the German colour works alcohol is treated almost like water. They are so accustomed to use it that they just put their stills up where probably you would not care to put up a special branch here. They use it for solvents where we should probably not use it.

But not as an alkylating agent, or for making alkylating agents.

190. Then for the second head, the production of ethylated dye stuffs, it would not be altogether unsuitable, would it?—Pure methyl alcohol is necessary for the one, and pure ethyl alcohol for the other.

191. Then you say, "For this purpose the alcohol is employed directly or after conversion into a more reactive form technically known as an alkylating agent; and for these alkylating agents alcohol is, I believe, absolutely necessary"?—Yes; they are practically alcohol made more suitable for use—that is all. You can regain the alcohol very readily from it.

Alkylating agents bought abroad; and some of them liable to Customs duty.

192. As you explained, anybody who wants to use those alkylating agents in this country has to buy them from Germany, I suppose; or are they made anywhere else except in Germany?—They are made to my knowledge in Switzerland, probably also in France and Austria. They are not used in this country on a large scale.

193. (*Mr. Tyrer.*) In no case?—As far as I know they are not used in a large way. They are certainly not used in the colour industry on a large scale, and I can only speak with certainty to that.

194. (*Chairman.*) Of course some of them are subject to a duty, and a very heavy duty; for instance, the ethyl chloride is 16s. 5d. the gallon?—Yes, but I do not know whether there is a duty on dimethyl sulphate or not. Dimethyl sulphate has only recently become a commercial article. It is the best and cheapest form of methyl alcohol for many purposes. There is no duty on dimethyl sulphate, but we know, if we imported it, it would be immediately investigated and a duty put on, because it is practically the same thing as methyl chloride—it is merely a sulphate instead of a chloride. It is a new substance, and it has only lately become of technical value.

195. Is that largely manufactured in this country?—No; it is manufactured in Switzerland and Germany in large quantities.

196. Do you happen to know whether there is any manufacture of it in this country?—I do not know of any.

197. With reference to what you have just said, that if you began to import it the duty would be put on, I do not know that it would be anybody's business to care about putting on the duty, unless it was being manufactured in this country, or unless it was imported in very large quantities?—I think Dr. Thorpe would probably take a sample.

198. As a matter of fact all those duties are not intended to be Revenue duties, but are intended to be duties in order to equalise the conditions as between the foreign manufacturer or the importer and the manufacturer in this country. If there is an absolute absence of manufacture in this country it is extremely likely that nobody would make any remark about it. Anyhow, if those that are now subject to duty were free from duty, as you rather suggest, and freed from all surtax as well, that I take it would effectually make the manufacture of those things in this country almost impossible?—The manufacture in this country is very unimportant, I think.

199. Is that so with some of these things like ethyl chloride?—I believe so.

200. (*Dr. Thorpe.*) There was the case of an ethyl iodide in the beginning of the industry, as of course you have heard?—It occurred to me that this was not a case where it would perhaps be necessary to put on a surtax, as in the case of imported spirits. In the old days the price of ethyl iodide was of no consideration, as profits were very large.

Free importation of alkylating agents would open up possibilities for the manufacture of intermediate products, but would hardly give an immediate impetus to British industry.

201. (*Chairman.*) If those duties were removed, and no similar duties put on other similar things, would it make a considerable difference to your own business, do you think?—I think it would.

202. Would you be then in a position to manufacture these intermediate products?—Some of them—not all of them.

203. Do you think that, given the start which the German manufacturers have got, it might be possible now, even at this late date, to profitably commence that manufacture here?—In most cases I do not think so. There is this one point to be borne in mind. We should not think of making anything which is already in the trade, unless we could make it exactly as cheaply as the Germans could. I mean to say that if the price of spirits was reduced, but did not come down substantially to the level of the German spirits, we would not think of making it, because the profit would be too small on the finished articles. But it would make a considerable difference for the future. This is a progressive industry, and colours may hold their own for some years and then be replaced by new ones. It would certainly facilitate us in our research in the direction of new colours, and in that way it would be very helpful. Of course there is the establishment of new industries in the future to consider.

204. The advantage then would be more in the direction that it might open possibilities?—It would open possibilities which are absolutely closed at present.

Importation of intermediate products.

205. I think you have already said that the importation of these intermediate products, such as monomethyl aniline, is not large?—I can only speak for our own consumption of them.

206 Do you suppose that there would be any possibility of ascertaining what the quantities are that are imported; do any trade papers keep special statistics of that?—I am afraid not.

207. I take it that in the official annual statement of trade they would all probably be included under the heading of "Chemicals or Dye Stuffs"?—Under the heading of "Chemicals," I should think.

208. Because they have not reached the point of becoming dye stuffs?—Yes.

209. I suppose you would say that every one of the intermediate products you mention in your *précis* requires pure alcohol?—Every one.

210. Absolutely pure?—Yes.

211. But it may be pure methyl spirit or pure ethyl spirit?—Yes, one or the other.

212. Do those, do you know, take a large amount of spirit to manufacture?—The quantity varies considerably.

213. You say "A number of alkylated dye stuffs are actually manufactured here from such intermediate products." I rather gather from what you have been saying since you have been in the room, that the importation of these intermediate products is small, and that the quantity of alkylated dye stuffs that is manufactured in this country is also small?—We use a considerable amount of dianisidine in the course of the year, and from that dianisidine we make a whole series of dye stuffs, all of the same type and bearing a certain relationship to each other. I was referring to those dye stuffs when I spoke of "A number" of dye stuffs.

Prices controlled by Germany, *e.g.* dianisidine.

214. You say that "until recently dianisidine could not be bought in this country under 11s. per kilo., whereas it can be made at a good profit at 6s. per kilo."; has it got down to nearly 6s. per kilo. now?—Yes.

215. What is the fall due to?—It is due to over production I think. Before that they would not sell to us for a lower price than that, and we cannot make it ourselves. Of course we made very much less profit on the finished dye stuff than they did, as we were making the same dye and competing with them.

Dr. H. Levinstein, M.Sc.

8 Nov. 1904.

216. Has that made a material difference to you in regard to the production of dye stuffs into which dianisidine enters?—Yes, it has. We have been making one certain dye stuff for years, which has been sold at a fair profit, but the price dropped, and we had to stop making it. We paid 11s. per kilo. for the dianisidine, and we were unable to compete with their dye stuff; but now that the price has dropped we have taken up the manufacture again.

Export trade.

217. With reference to the products that you make; is your market largely in this country?—Yes, it is, but not entirely, of course.

218. Then you do a certain amount of export?—We do a considerable export trade, but the great part of our trade is in this country. We export a considerable quantity to Germany, Italy, Spain, the East, America—in fact, all over the world.

Alcohol as an alkylating agent, for brightening and fastening colours.

219. You first deal with the alcohol as applied to the intermediate product, and then you come to the alcohol as applied to the finished dye stuff as an alkylating agent; and you mention certain colours which are treated with alcohol or some other alkylating agent, in order to make the colour fast, as I understand?—Sometimes to make it faster and sometimes to make it brighter. I have mentioned in my *précis* these three methods, although it is rather technical, because I thought it might be of assistance to you to know exactly how the alcohol is used.

220. As a matter of fact, at this moment, would it be a great advantage to you to be able to use alcohol in this particular way; in other words, if you were allowed to use unmethylated spirit and a pure spirit duty free, would it help your manufacture much?—Yes, in all these colours mentioned at this point in my *précis*.

Even duty-free pure spirit too costly for this purpose, except at same price as in Germany.

221. You mention on the next page two particular new dye stuffs which your firm are interested in. You say, "Two new dye stuffs belonging to the same series, but one dyeing cotton green and the other blue, have recently been discovered and put on the market by Messrs. Levinstein, Ltd," and then you go on practically to say that you are hampered in dealing with those two new dye stuffs by the impossibility of using alcohol as an agent for fixing and brightening the colours?—Yes, that is so.

222. Would you be glad to use duty-free spirit for these purposes?—Certainly, if it was at a reasonable price we should use it at once.

223. Even at its present price?—No, we would not use it at its present price.

224. (*Dr. Thorpe.*) Duty-free price do you mean?—At its present duty-free price we would not use it.

225. (*Chairman.*) When you speak of a duty-free price are you speaking of the price of methylated spirit or of strong pure spirit?—For this purpose we should want strong pure spirit.

226. The present price of that might be taken at what—would it be 1s. 4d. to 1s. 6d., or something of that kind, per gallon?—I should think about 1s. 6d.

227. At 1s. 6d. would it not pay you to use it?—I should think it probably would not pay us to do so, because we would have to be prepared for the price of these dye stuffs coming down if we made them in a large way. We should not go to the expense of making them in a large way unless we were prepared to meet the competition which we should have to face from Germany.

228. Would the quantity of alcohol that you would use in this particular way be large in proportion to a pound of the dye stuff?—It would be very considerable.

229. Would you put it as strongly as this: that unless you could get it at practically the same price as the German manufacturer can get his, it would not be worth your while?—That is my view. It is not worth while risking a lot of capital in it unless you start on level terms.

230. (*Mr. Tyrer.*) Are we to understand that for the preparation of these particular dyes under discussion you would require a pure undenatured alcohol? Is there any form of denaturing that would assist you in the matter?—I should not say that.

231. Would the ordinary methylated spirit do?—The ordinary methylated spirit would not do.

232. But denatured in some way approved on the one hand by the Excise and suitable for your purposes on the other would do?—Yes.

233. My point is that it is not absolutely necessary that you should have pure spirit undenatured and untouched in any way?—No.

234. (*Chairman.*) Probably that at any rate would not cheapen the spirit, would it?—It would probably make it dearer.

235. Some little bit dearer?—Yes.

Finance Act, 1902, s. 8, of no practical use to witness's business at present price of spirit. (*See also* Q. 261-2.)

236. Then on the next page you refer to the Finance Act of 1902, and what you have been saying just now answers very much what I was going to put to you upon that. You state there that if your alcohol is to be 50 per cent. dearer than it is in Germany, then really the Finance Act of 1902 is not of very much use to you?—As far as we are concerned it is not.

237. You do not quite accurately, I think, describe it, but perhaps that is a slip of the pen. You say: "The nett result of this Act has been to confer upon manufacturers the privilege of obtaining pure alcohol under certain restrictions at the same price as methylated spirits." That is not quite so. What the Finance Act of 1902 did was to let people use pure spirit denatured in a special way so as to be suitable to their particular manufacture if necessary, and even in the last resort in certain cases possibly to allow them to use pure spirit without any denaturing, even in the works. Of course the price would be affected by that, but even the specially denatured alcohol would probably be rather cheaper than the methylated spirit?—Yes. I do not think that passage in my *précis* was quite accurate.

238. Then you say: "The price of methylated spirits is in this country from 1s. 6d. to 2s. per gallon, while in Germany the price varies from 6d. to 10d. per gallon"; I fancy that now it is a good deal higher there?—At the present moment it is high.

239. It is over a shilling I think?—It is over a shilling I believe at the present moment.

240. The price varies very quickly?—Yes.

Other industries abroad using alcohol. Synthetic perfumes, *e.g.* artificial musk.

241. As regards other comparatively new and flourishing industries which have been established abroad, you say that the preparation of synthetic perfumes is an industry which has attained enormous proportions, probably comparable in size with the German colour industry; is that really so?—As far as profit is concerned I should think so. I know that on one single article, artificial musk, one firm in Switzerland, or Alsace rather, made no less than a quarter of a million clear profit.

242. Not much of it, I am glad to say, comes to this country?—I do not know about that. It mostly went to France, and I think quite probably it does come here eventually.

243. I do not think that the import of these artificial perfumes into this country is very large?—I have not consulted the figures, but I believe the principal exports are towards France, where the soap and perfumery trade is very important. I believe the imports into this country to be considerable.

244. With regard to those substances that you mention, vanilline, heliotropine, citral, and so on, is the alcohol present in them in a free state? Can it be recovered?—I am not sure how they are brought on the market. I am speaking of the basis of them. They are definite chemical compounds, which are brought on the market in various forms as essences and so on. I should think there is a good deal of vanilline imported here.

245. (*Mr. Scott-Montagu.*) Is that imitative of vanilla?—Yes, it has the flavour of vanilla. The soap people here use very large quantities of some of these things.

246. (*Mr. Tyrer.*) There are only two of these which are liquid?—Yes.

Artificial Silk. (*See also* Q. 259-60.)

247. (*Chairman.*) They may come in under the head of perfumes; there is a certain amount of perfume imported, but there is not a great deal of perfumed spirit. Then you refer to artificial silk, but on that subject you do not speak from personal knowledge, do you?—No, I only speak from what I have been told by people who are engaged in the manufacture. I believe the figures I give in my *précis* are correct.

248. I believe it is an industry that is developing very rapidly?—Yes, astonishingly.

249. I am told that all their goods are sold before they have begun to make them, there is such a demand?—The demand has been enormous.

No immediate possibilities for such industries in United Kingdom.

250. (*Mr. Tyrer.*) The facts are substantially as stated here. The artificial silk industry at Coventry, I believe, failed practically because of the high price of the alcohol, but there were other reasons for its failure, for instance, the immense building and outlay at Coventry ?—That is a very good instance of the difficulty we shall have later on. Supposing you enable us to make the Chardonnet silk, the one that paid 125 per cent., it would take us years before we could make it in this country. It took the Chardonnet people ten years before they brought their silk on to the market, owing to the technical difficulties being so immense. If we want to make it here it would probably take us many years before we could produce a marketable article.

251. Unless you bought your experience ?—Unless we bought our experience.

252. (*Chairman.*) You say the Chardonnet patents have most of them expired ?—Yes, I should say most of them have.

253. So that anybody could take up the process now ?—Yes.

254. (*Dr. Thorpe.*) If they had the necessary skill ?—If they had; and even then I think very few people would be bold enough to take it up.

255. (*Sir W. H. Holland.*) Did the other firms you have mentioned have patents; take Die Vereinigte Glanzstoff Fabriken, for instance ?—Yes.

256. Are their patents still running ?—Yes, they are.

German Cartels raise prices to British consumer: *e.g.* artificial indigo. (*See* next Q. 269-74.)

257. (*Chairman.*) In connection with the German cartels, you mention that already the prices of certain articles in which the five firms who have been amalgamated into two are interested have already been appreciably raised to the British consumer ?—Yes.

258. Could you mention the articles ?—Synthetic indigo is one. These firms have already a complete control of the alizarine market, and have raised prices 27 per cent.

Artificial Silk. (*See* ante Q. 247-56.)

259. (*Mr. Tyrer.*) In connection with the Chardonnet process, you say that that process "is known as the Collodion process, and large quantities of alcohol are employed." Have you any idea what is the quantity of alcohol employed in the Chardonnet industry ?—I have no idea. I suppose it is something similar to that employed in making explosives in the Government works.

260. (*Chairman.*) I believe it is very large ?—It is very large.

Finance Act, 1902. (*See* ante Q. 226.)

261. (*Mr. Scott-Montagu.*) You have already answered to a certain extent the questions which I was going to put to you. I did not happen to see at first that you had referred to the Finance Act of 1902. That Act has not in your case been of any great help to you ?—No.

262. Because, although you get a certain advantage, you still have the disadvantage of the too high price which you have to pay for the alcohol, whether it is methylated or not ?—That is so; and the machinery is very cumbrous too. Speaking broadly, a manufacturer cannot engage in an article in competition with the Germans—he not only cannot, but he will not put up works—unless he can start on a fair basis and on equal terms.

Cost of production with duty-free and duty paid alcohol compared Di-ethylaniline.

263. I do not know whether I could take such a thing as an average pound of dye, and I do not know whether you can answer a question on that basis. How much alcohol enters into the manufacture of one pound of ordinary dye ? Take, for instance, an ordinary blue dye on which you get your largest profit, would it be fair to take it on a basis of 2s. per pound, and, if so, how much out of that 2s. would represent the alcohol ?—It is very difficult to give you that calculation.

264. In the earlier part of your *précis* you say that supposing a man manufactures one pound of di-ethyl-aniline, the cost of manufacturing it from duty-free alcohol is about 5½d., and from duty-paid alcohol 2s. 5½d.; that would lead one to the conclusion that 1s. 11¾d. would be the cost of the alcohol in that particular case, which seems an extraordinarily high amount ?—That is not a finished dye stuff, that is an intermediate product which is pretty highly ethylated.

265. In that particular case of the di-ethyl-aniline 1s. 11¾d. is the difference between the two; would that be represented by the duty ?—The calculation was made some time ago, and I am not quite sure whether that represents the theoretical amount of alcohol in the di-ethyl-aniline—whether the calculation was made by simply taking the amount of alcohol which is actually in the dye stuff, or whether it is a calculation made by taking, as one actually does on a large scale, a large excess of alcohol. You take a large excess of it and you get a certain amount into the dye stuff. That is, a certain amount you lose, and a certain amount you recover.

266. It struck me as a tremendously large difference ?—Yes, it is.

267. I want to ask you the question which I asked of your predecessor in that chair. Do you consider that the aniline dye trade has been severely handicapped owing to the high price of alcohol in this country during past years ?—I think it has been almost absolutely ruined.

Prospects of recovery of English dye industry with freer use of alcohol.

268. Do you think that if you had any alterations made in your favour, that means to say that you could use duty-free alcohol under proper safeguards to the Revenue, that that would enable you, not at once, but eventually, not only to retain what you have got, but to recover a certain proportion of what you have lost of that trade ?—Yes, a certain proportion. It is also of importance to the dyers and printers of this country that the manufacture of ethylated dye stuffs should be rendered possible in this country, owing to the recent formation of a cartel among the leading German colour works. It is important to the consumer that the base of supply should be widened.

Artificial indigo. (*See* Q. 257-8.)

269. (*Dr. Thorpe.*) In respect of the raising of the price of artificial indigo, surely that at once gives a fresh lease of existence to natural indigo ?—I do not think so, because natural indigo is a very awkward thing for the calico printers to handle, and is considerably dearer.

270. They have not had many years' experience of the artificial indigo ?—They have had experience enough to make them disinclined to go back to the natural; and the price of the natural indigo is considerably dearer still.

271. In the event of the price of artificial indigo being so largely raised as you anticipate, I still suggest that the natural indigo may have a fresh lease of existence ?—I do not think so. They could raise the price of artificial indigo considerably, and it would still be cheaper than natural indigo; and I think if they brought it up to the same price as the natural indigo the consumer would prefer not to have natural indigo for certain purposes. For certain other purposes, of course, natural indigo is preferred.

272. For dyeing woollens, for instance ?—For dyeing woollens I think it is preferred by many.

273. Dyeing woollens is the largest industry for which indigo is used, is it not ?—Possibly. But a very large amount is used for dying cottons and for calico printing. Indigo has been replaced by many other dyes for dyeing woollens, such as the alizarines, but the Government insist, and very rightly, on having the natural indigo in their work.

274. (*Chairman.*) Is that for the bluejackets ?—Yes. They do not always get it, but I think they ought to do.

Perfumes and flavours. (*See* Q. 241-6.)

275. (*Mr. Scott-Montagu.*) I suppose there is an indefinite extension possible in the use of these perfumes and flavours ?—Yes.

276. Therefore there is no reason why a portion of that trade should not be regained ?—No. That trade is comparatively new, and I think we should regain a great part of it probably. Then new things are always being made.

Attitude of English manufacturers in face of German competition attributed to realization of the fact that progress was impossible without duty-free alcohol.

277. (*Mr. Tyrer.*) In that connection do you think the scientific ability at the disposal of the English manufacturers or capitalists is to-day equal to the production of these up-to-date new colour products to which reference has just been made ?—I think it is. I think that the people who are looking after the industry here are fully equal to the Germans.

278. Are you aware that one of the statements made in explanation of the decadence of the industries with which you are very much associated, and to which you have just referred, is that it is not so much due to the price of the alcohol (though it is not denied that that has had an effect) but the greatest cause, putting it very plainly indeed, is said to be the incompetence and the inability of the English scientific man—the student or whoever he may be—to rise

Dr. H. Levinstein, M.Sc.

8 Nov. 1904.

to the height of his opportunity. Do you think that any time since 1880, for instance, he has been equal to the position, supposing the conditions had been nearly like those of Germany ?—I was fully aware of that statement, and I have had it in my mind in the evidence that I have laid before the Committee. I think you are possibly alluding to a statement of Green's that the manufacturer cared nothing for research. In fact I think Green put it that the manufacturer thought more of the benzol market than of the benzol theory. My point is that in the days when these products, the various derivatives of coal tar, first became commercially accessible, it did not pay anybody to go in for research on a large scale, because such a large proportion of the products, I should think 80 or 90 per cent. of them, could not be made here owing to the duty on alcohol. I think it is not right, not correct, and not logical to say that it was incompetence on the part of the English manufacturers not to go in for research in the same way as the Germans. They would have had to spend a great deal of money in researches of very great difficulty, because research chemists require very high salaries if they are any good. I say it would have been an act of incompetence on their part to go in for research in the way the Germans have done, when they knew that the bodies which they might discover could not be made on a large scale afterwards.

Field of research narrowed by duty on alcohol.

279. (*Sir W. H. Holland.*) You suggest, as I understand you, that the field of research is very greatly narrowed by the duty on alcohol ?—It is very greatly narrowed indeed.

280. Probably if there were free scope given in that direction you would increase enormously the number of chemists you employ ?—We most decidedly should; and were it not for the duty we should to-day be doing what our competitors are doing, namely, making every kind of coal-tar derivative that could possibly be made, and not only colours, because colours form but a very small part.

Necessity for Excise supervision and its extent, if duty free alcohol were used in the dye industry.

281. (*Mr. Scott-Montagu.*) Do you suggest that there would be any difficulty in protecting the revenue against fraud if you were allowed to use alcohol ?—I am not prepared to express any opinion upon that at all.

282. Do you anticipate there would be any difficulty ?—I anticipate it would have to be very carefully thought over, and very carefully gone into by experts—revenue officers, and so on.

283. (*Chairman.*) Could you say whether or not the conditions of manufacture in your business are such as to give many openings for individual working men to get at the spirit ? There may be very great differences between one factory and another as to how the spirit is used. If the spirit is all carried through pipes and closed vessels, then the individual cannot get at it, and perhaps there would be less difficulty than there would be in another case where the people have to be always dabbling in it ?—In our case closed vessels would practically be employed nearly always for purposes of economy.

284. Therefore, not more than a certain number of workmen ever have access to the spirit ?—Probably not.

285. (*Mr. Tyrer.*) Are you aware of the amount of supervision that is considered necessary in England, and are you aware of the amount of supervision that actually exists in Germany ?—No, I am not at all posted on that.

286. Let me put it in another way. Is it within your knowledge that the supervision in Germany is effective, and would the precautions taken in the works over there with cheap spirit be effective as against the misuse of dear spirit here, as far as you know ?—I understand you to mean: Do you think the temptation to misuse is greater here than it is in Germany, owing to the greater cost of the spirit ?

287. Of course, that would be the revenue difficulty, and if the spirit was cheap the difficulty would not be so great. Bearing in mind the enormous difference between the two, and assuming for the moment that the German or French workman is liable to go in for taking nips like the Britisher, would the precautions which are taken over there, so far as you know, be efficient here, without regard to the price ?—I see no reason to assume the contrary.

288. Have you ever examined into that point ?—I have never gone very closely into it.

289. Have you found that the regulations were sufficient, in your opinion, to protect the revenue, however high in price it might be ?—I have never gone into it from the Treasury point of view, but from the manufacturer's point of view I can say this much—that the German restrictions are not unreasonable, and do not entail a great cost upon the manufacturer. I think a point one is apt to overlook is that if we had to go to a great expense before we commenced making an article, or if any manufacturer is hampered by great expense before he can commence, it would make him exceedingly disinclined to go into it, because, after all, in every commercial undertaking there is a considerable amount of risk that it will not be successful.

290. (*Chairman.*) On the other hand, you would have certain advantages, would you not, over your German competitors as regards, for instance, the raw material, coal tar ?—That advantage is a thing of the past, I am afraid. We used to have it, but we have not got it now since the Germans started coke-ovens.

291. (*Sir William Crookes.*) If great supervision over alcohol in works is necessary to prevent individual workmen occasionally drinking it, I should think that could be very easily stopped by picking out the drunkards and dismissing them. You could easily get sober workmen who would not succumb to that temptation. It has always struck me that the necessity for supervision was in order to prevent larger quantities of alcohol getting out of the works by some underground means and being made commercially into whisky, and that it is not the individual tippling that would be of very much consequence ?—I should imagine not, because in the individual case it would bring its own cure. If there was too much tippling you would soon find out the men who took it.

292. And the amount would be small even if there was not very much supervision ?—Yes, certainly. The amount which can be consumed in the works is practically nothing, I should think. If the men had too much they would get drunk, and you would discover them.

293. (*Mr. Tyrer.*) Nevertheless, the supervision abroad is efficient ?—I am quite sure that the supervision in German colour works is very thorough, and it works well. I am quite sure about that. So much would depend upon the branch of the industry that you are considering.

294. (*Chairman.*) You are quite right, for, of course, circumstances really determine the matter; in some cases it might be perfectly possible to control it, and in othercases it would not ?—I think in our case we should probably have a branch of the works where everything would be closed up, and we should charge under pressure and distil off the alcohol, and probably continue straight away.

295. I suppose you do use a certain quantity of alcohol in your works ?—We do not use any whatever.

296. Not even in your laboratory ?—Yes, in the laboratory, but I understood you to say in the works. In the laboratory we use some, certainly, but we do not use it for manufacturing.

297-8. (*Sir W. H. Holland.*) You have told us, I think, that you could not give us any first hand information with regard to artificial silk ?—No. I have not seen any of the factories.

299. (*Mr. Nicholson.*) In all cases where you have been mentioning alcohol, are we to understand you to mean highly rectified alcohol ?—Pure alcohol.

300. 95 per cent. ?—Approximately, 95 or 96 per cent.

301. You have some experience of the Excise supervision in Germany, I believe ?—No, I have no practical experience at all of that.

302. You cannot tell me who bears the cost of it as used in industry ?—No.

303. (*Mr. Scott-Montagu.*) Out of the ninety-five million gallons of alcohol made in Germany last year can you tell us what proportion of that is used in the aniline dye trade ?—No, I could not tell you.

304. Have you any idea; is it one-third, or that sort of thing?—I should think the greater portion is used for motor purposes.

Chief use of alcohol abroad is for heat, light and power, such use being generally stimulated by a high duty on petroleum

305. For heat, light, and power?—Yes, far away the greater portion is used for that, and in fact that is the real importance of it. As far as the figures go, that I imagine is the chief use for alcohol. That is the point of view from which it is regarded in Germany, in France, in Austria, and in Russia. I have here an account of an exhibition of alcohol which was held in Vienna this year which I will hand in.

306. Is that the exhibition to which the German Emperor sent a potato with an appropriate inscription?—I really do not know. I have also an account of the exhibition in 1901.

307. (*Mr. Nicholson.*) The use of alcohol is largely affected, is it not, by any import duty there may be on petrol?—Of course, putting an import duty on petrol is a way of increasing the use of alcohol. I have some figures for Germany in 1899. Their consumption of alcohol for industrial purposes in 1899 was 11,000,000 gallons, and it went up by 700,000 gallons, while the consumption of petroleum went down by 500,000 gallons.

Dr. H. Levinstein, M.Sc.

8 Nov. 1904.

308. (*Mr. Scott-Montagu.*) There being rather a large duty on petroleum going into Germany?—I do not know about that.

309-10. Holland and Belgium are the two duty-free countries with regard to petroleum?—It is the definite policy of some countries to exclude petroleum in favour of the production of their own soil. Monsieur Boverat, when opening the Alcohol Exhibition in Paris in 1901, said: "Nothing is more important for the future of not only agriculture, but the whole of France, than the work at whose accomplishment the Congress aimed—namely, to provide the country with a heating system, a method of illumination, and a source of power which springs from their own soil." I suppose a duty on petroleum would be in accordance with that.

SECOND DAY.

Wednesday, 16th November, 1904.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair*).

Professor Sir WILLIAM CROOKES, F.R.S.
Sir W. H. HOLLAND, M.P.
The Hon. J. SCOTT-MONTAGU, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. W. SOMERVILLE.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*).

Professor ARTHUR GEORGE GREEN, called; and Examined.

311. (*Chairman.*) I think you are one of the witnesses who have been selected to represent the London Chamber of Commerce?—Yes.

312. You hold a position in the Yorkshire College, do you not?—Yes; I am Professor of Tinctorial Chemistry and Dyeing there.

313. In the past have you had any business connection with the aniline dye industry?—Yes, I have had about twenty years' experience in the aniline colour industry.

314. What firms have you been connected with, and in what capacity?—I was connected with Messrs. Brooke, Simpson & Spiller for nine years, and with the Clayton Aniline Company for seven or eight years. I was manager of the colour department of the Clayton Aniline Company.

315. Have you ceased to hold any position under those companies?—Yes, excepting consulting positions. I am no longer in the employ of any firm.

316. Since what date have you been unconnected with any firm?—About three years ago I left the Clayton Aniline Company.

317. But as consulting chemist you still keep in touch with the industry, I presume?—Yes, I still remain in touch with it.

Alcohol in aniline dye industry. Concession by Board of Inland Revenue to Clayton Aniline Co. not made use of. (*See* also Qs. 390-413.)

318. During the time that you were connected with those firms, was it brought before you that there were difficulties in connection with obtaining alcohol, either as regards the character of the alcohol to be used, or the price at which it had to be obtained, and that those difficulties were seriously impeding and hindering the industry?—During the time I was manager at the Clayton Aniline Company the question came up on several occasions, and there was a considerable amount of correspondence between the Clayton Aniline Company and the Board of Inland Revenue at the time.

319. About how long ago was that?—That would be, I should think, six or seven years ago.

Prof. A. G. Green.

16 Nov. 1904.

320. That correspondence was on the question of denaturing by some other method than the recognised method of methylation, was it not?—Yes, that is so.

321. I think the Board offered some concessions, did they not?—Yes. I think the concession they offered was ⅛ of 1 per cent. of petroleum added to the methyl alcohol. That probably might have been satisfactory, but although I endeavoured very hard to get the Clayton Aniline Company to make use of the concession, they did not see their may to do so at the time, and the matter dropped.

A large class of colouring matters (including azo-dyes) requires no alcohol.

322. Turning now to the present position of the industry, I see the first heading in your *précis*, upon which you desire to speak, is the need for pure cheap methyl and ethyl alcohol in the manufacture of a large class of coal-tar colouring matters. Is there not a large class of coal-tar colouring matters in connection with which alcohol is not required at all?—Undoubtedly.

323. Is that class increasing or diminishing; in other words, is the tendency to avoid alcohol and to use substitutes?—I do not think there is any tendency to avoid alcohol. There is no reason why alcohol should be avoided in Germany. But progress has largely been directed to the azo colour industry, and in the manufacture of the azo colours alcohol only enters in the case of a few individuals. The majority of the colouring matters of the azo class are not manufactured from alcohol.

Alcohol as a solvent. Purity important.

324. Now as regards the purity of the alcohols employed; when alcohol is used as a solvent, its purity is not necessary, that is to say, the ordinary methylated spirit is sufficiently satisfactory, is it not?—That depends entirely upon the purpose. Are you speaking of the

Prof. A. G. Green.

16 Nov. 1904.

colouring matters themselves, or of the raw products for the colouring matters.

325. We might take both?—It is more a question of the raw products, I think, in which the alcohol enters as a solvent, although there are a few cases also in colouring matters. As a rule, the purity of the alcohol is a very important factor when it is used as a solvent. The presence of acetone in methylated spirit is very detrimental and tends to form condensation-products, which means loss and contamination of the product.

326. As between those two methods of use, that is, as a constituent or as a solvent, which demands the larger amount of alcohol?—As a constituent. I have here a table which will give you some idea of the quantity of alcohol used as a constituent in a number of colouring matters which I have taken as typical.

Alcohol as a constituent of product. Proportion in typical dyestuffs (not including quantity lost in manufacture.

Name of Dyestuff.	Percentage of Methyl Alcohol.	Percentage of Ethyl Alcohol.	Price per lb. (wholesale) for pure Product.	Unpaid Duty per £100 value.	Estimated Annual Imports.
			s. d.	£	
Malachite green - - -	27	—	2 3	34	10 tons
Methyl violet - : - -	40	—	1 6	75	Difficult to estimate
Gallocyanine - - - -	21	—	2 0	30	5 tons (?)
Methylene blue - - -	33	—	3 6	26	Difficult to estimate
Auramine O - - - -	40	—	1 11	59	45 tons
Victoria blue R - - -	28	10	1 10	59	30 ,,
Brilliant green - - - -	—	38	2 3	48	10 ,,
Patent blue V - - - -	—	34	2 3	43	45 ,,
Rhodamine B - - - -	—	38	5 0	21	15 ,,
Rhodamine 6 G - - -	—	20	20 0	4	30 ,,
Chrysophenine - - -	—	13	1 8	22	Difficult to estimate, but very large.

N.B.—The above figures take no account of alcohol lost in the process of manufacture. It is also to be noticed that the calculations are made for pure dyestuffs, whilst many of the commercial dye stuffs are more or less diluted with salt or dextrine. The calculations are made upon the *most important brands;* with other brands the alcohol contents will vary, and sometimes one alcohol may be subsituted for another. For example: Auramine O contains methyl-alcohol groups, Auramine G contains ethyl-alcohol groups.

I have given in this table either the percentage of methyl alcohol or the percentage of ethyl alcohol which each of these colouring matters contains—in the pure colouring matter that is; because in some cases methyl alcohol is used, and in some cases ethyl alcohol. In another column I give the price per pound wholesale calculated on the pure product; in another column I have calculated per £100 value the duty which is unpaid on the alcohol contents of these colouring matters, and therefore on their radical contents; and I also give the estimated annual imports, which you see come to a very considerable amount.

327. Taking, for instance, the first column, which gives the percentage of methyl alcohol, does that represent the percentage of the alcohol constituents in the finished product?—Yes; it is the percentage of alcohol corresponding to the ethyl or methyl groups absolutely contained in that dye stuff, but it takes no cognizance of the loss of alcohol, which, of course, is inevitable in the manufacture. There is really a much larger amount of alcohol used than is shown in the table, because the table only gives the absolute quantity which is contained in the dye stuff.

328. For the purposes of the Committee, it seems to me that the most convenient form in which to have a table of this kind would be to have a column which showed the amount of alcohol consumed in producing a given amount of the product. Instead of showing what is the percentage represented in the finished dye stuff, could we have the amount of alcohol consumed in producing a given quantity of the product? Could we deduce that from this table which you have just handed in?—It could not be deduced from that, but I think Mr. Tyrer has given it in his paper in a table by Mr. Leuthardt-Thornton. It varies with every colouring matter. With some colouring matters you may have a nearly theoretical yield with very little loss of alcohol, and in others you may have a comparatively theoretical yield with a very big loss of alcohol. Only a man who manufactures these particular colours would be able to tell you what is the absolute loss in his products. I cannot give you that, because I have not manufactured any of these articles, and because none of these articles have been manufactured in this country, excepting from intermediate alcoholic products which are imported.

329. Now taking the column headed "Unpaid Duty per £100 value," I see that against malachite green you have put £34; that means, does it, that the £100 value would have been increased to £134 if duty had had to be paid upon the alcohol employed?—Yes.

330. That is the duty alone, irrespective of the price of the spirit?—Yes, quite irrespective of the price of the spirit; you may take it that the price of the spirit is included in the £100 value.

331. As a matter of fact, I believe duty-paid spirit is never used, and never has been used for this sort of purpose?—That is so.

332. It is out of the question?—It is absolutely out of the question.

333. But it would add 34 per cent. to the cost of production of that particular colour?—Quite so. It is also equally out of the question to use methylated spirit.

Methylated spirit unsuitable for such dyes.

334. On account of its character?—Yes—chiefly on account of its containing acetones, or rather ketones.

335. Even what we call the ordinary methylated spirit, that is to say, methylated spirit with 10 per cent. of wood naphtha, is out of the question?—Yes.

336. (*Mr. Tyrer.*) What, broadly speaking, do you think the loss of spirit in manufacturing would be?—The loss on manufacture varies within such very wide limits that it is difficult to say, broadly speaking, what it is. It might be as little as 10 per cent. in some cases (but I should think in very few cases would it be as little as 10 per cent.), and it might run up to 50 per cent. It is not like a case of recovery. It means that the intermediate product containing the alcohol is more or less wasted, the yield of the colouring matter not being theoretically perfect.

Loss in manufacture varies with different dyes.

337. In other words, there would be secondary products formed?—There are secondary products formed.

338. Which would have no value, would you say?—They may have some value.

339. And could probably be utilised in some other operation?—In some cases; but the conditions change completely with every special case.

340. (*Chairman.*) You say that the ordinary methylated spirit is not suitable. You know, of course, the provisions of the Act of 1902?—Yes.

Finance Act 1902, s. 8. Special denaturants possible. (*See* Qs 508-518.)

341. That Act would permit of the Board of Inland Revenue giving authority to use spirit denatured in some other way, that is, denatured in a special way?—Yes.

342. Would it be possible to devise special ways for denaturing in connection with the coal-tar colouring matters ?—Undoubtedly. Of course it all depends on what you require as a denaturing agent; but I think it would be easy enough to devise means to render the spirit unpotable for the time being, although it is difficult to make it impossible to recover the pure spirit.

Recovery of spirit.

343. (*Mr. Tyrer.*) Would it be possible to recover the pure spirit under ordinary supervision ?—I say it would be difficult to select denaturing agents which it would be impossible to remove.

344. (*Chairman.*) When alcohol is used as a solvent, can the spirit be recovered and used again ?—Not the whole of it. Of course there is always a loss, ranging from 5 per cent. to 10 per cent., so that you may recover from 90 to 95 per cent. where it is used as a solvent.

345. When used as a constituent, I presume there would be none that could be recovered ?—It will entirely enter the compound then.

346. Now, in paragraph 4 of your *précis*, you say that the home manufacturer is prevented from competing with the foreign manufacturer by having to pay duty on all the alcohol which he consumes in his business. That would only be true, would it not, before the year 1902, when he was obliged, if he used spirit at all, to use methylated spirit ?—Yes.

Denaturing, its expense a deterrent to manufacturers and unecessary in interest of Revenue.

347. Since 1902 he would not be obliged to pay the duty, but he would be obliged possibly to incur some slight expense in rendering the spirit temporarily unpotable; would that condition in itself, do you think, militate much against the home manufacturer ?—I think the facilities should be made as easy as possible to the manufacturer. It is not an easy thing to take up a new manufacture which has already attained large proportions in another country. The English manufacturer is very disinclined indeed to take up any new manufacture at the present time, and he will only do so if it is very easy for him to do so; if he is under all sorts of disabilities and vexatious restrictions, he will not bother himself. I am certainly of opinion that the revenue will not be endangered by giving facilities which would not be vexatious and would not be expensive to the manufacturer. In my own experience in regard to alcohol in use in an aniline colour works, I have always found that the workmen were very loth indeed to touch it at all. They look upon anything they find in a chemical works as poisonous. I think you will find it very difficult indeed, however good the spirit is, to induce them to touch it. They have an idea that it may contain aniline, or that it may contain something else which is poisonous, and therefore they are very careful indeed about it.

Little risk of misuse of pure spirit.

348. We had it in evidence at our last meeting that, as a matter of fact, the number of workmen who would have access to the spirit in such a way that they might abstract it would not be large ?—Certainly it would not. Of course, proper manufacturing books would be kept showing exactly how the spirit was used, and the quantity which was used, and the chemist in charge would have to account for it. He would have to show that he had in hand the amount of alcohol which his books recorded.

349. And not many of the men employed in the works would really have to handle the spirit, or indeed, would have an opportunity of handling it ?—You could insist that only the foreman in charge, and the chemist who was dealing with the particular colouring matter with which the alcohol had anything to do, should have the handling of it. It might be kept under lock and key, and they alone might have the key.

A difference of 6d. in price of spirit in England as compared with Germany would prevent competition by English manufacturers, who have no compensating advantages.

350. As regards price, do you consider that a difference of say 6d. per gallon would seriously handicap the industry in this country, supposing, that is, manufacturers were allowed to use pure spirit and that the minimum price of spirit in this country from various causes was as much as 6d. more than the German price ?—I do. I think that would be almost fatal. You see this difference is very great indeed. The aniline colour industry does not present the profits now that it used to present. Prices are cut very fine, and that difference would be very material—in fact, the difference between, say, 10d. per gallon and 1s. 4d. per gallon would make all the difference in the manufacture.

351. Then may we take it, as one witness put it to us last week, that that difference would be enough, in your opinion, to prevent anybody embarking upon the enterprise ?—Yes. If you take the case of diethyl-aniline, I have a calculation here which I need hardly put in, however, in which I show the difference in cost price between using taxed alcohol and alcohol at the price at which they have it in Germany. Suppose you made the comparison not between taxed alcohol and German alcohol, but between alcohol at 10d. per gallon (which is the price paid in Germany for alcohol) and alcohol at 1s. 4d. per gallon. Diethyl-aniline, with alcohol at 10d. per gallon, would cost 4d. per lb. for materials, while the same materials with alcohol at 1s. 4d. per gallon would cost 5d. per lb.. You see, therefore, that it makes a difference of between 4d. and 5d. or a 1d. a lb., on your raw material. It is, in fact, 25 per cent. more, and that would be practically prohibitive; it would make such a big difference that you could not satisfactorily compete with the German manufacturer who had his raw product 25 per cent. cheaper.

Diethyl aniline.

352. Now, taking the other materials, may the home manufacturer not have advantages as regards them; take the coal-tar itself, for instance ?—The material I have taken, viz.: diethyl-aniline, is one of the most important intermediate products between the coal-tar benzene and the alcoholic colouring matters which are made from it. I should like to put in a paper here in which I give a large number of products which are made from methyl alcohol and from ethyl alcohol, or in the manufacture of which pure methyl or ethyl alcohol is required as a solvent. (See Statement A page 22).

353. Going back for a moment to the point we started from, that 6d. per gallon on the price of the spirit would be prohibitive, because it would increase the cost of the materials by as much as 1d. per pound in the particular articles you mention ?—Yes, and that would be a great deal more than 1d. per pound on the colouring matter. The colouring matter is made from this raw product which costs 4d. per pound, and the colouring matters which are made from it are valued at from two, three, four, or five, or more shillings per pound.

354. Looking to the fact that the German industry has so thoroughly established itself, would it be impossible for the industry to be started here with hopes of success, if there was any difference in the price of alcohol; I mean might there be compensating advantages, apart from the alcohol, for a manufacturer in this country, that might counterbalance the slight disadvantage in the matter of the alcohol ?—I know of none. At the present day I think the English and the German manufacturer are absolutely upon a par with regard to the cost of the materials, the cost of labour, and other conditions. At one time the English manufacturer had a certain advantage in the fact that he had cheaper raw material, but now that is no longer the case, and the German manufacturer has equally cheap raw material all round.

Coal Tar as raw material (*See* also Q. 527-30.)

355. Does not the German manufacturer to a certain extent depend upon the English supply of coal-tar ?—There is a considerable amount of coal-tar sent from England to Germany, but he does not depend upon it, because he can get it in Germany if he wants to do so. At one time, nearly the whole of the benzol used by the German manufacturers came from England; but now all they require can be produced from the German coke ovens.

Alcohol as a constituent of medicinal preparations. High price not so serious a handicap as in the Aniline Dye Industry. (Q. 363)

356. In your fifth paragraph you refer to the synthetic medicinal preparations, such as antipyrine, phenacetin, and sulphonal; does alcohol enter to a large extent into the manufacture of those ?—Yes, to a very large extent. I should like to put in a paper with regard to that. I have a list here, which I have not made myself, but which I entirely agree with, of medicinal agents into which alcohol enters and which require pure alcohol. I have, as you will see, prefaced a few remarks. (See Statement B, pages 23-4).

357. In this table do you give the quantity of alcohol used ?—That table gives you the quantity of alcohol, either methyl or ethyl, which enters into the constitution of the compound.

358. There, again, that does not tell us what amount of alcohol is absolutely consumed in producing a given quantity ?—No, that is not given. It is an extremely difficult thing to give, and only the manufacturer can give it to you. From the formula of the compound any chemist can calculate how much alcohol it corresponds to, but it is not possible to calculate what is the loss in

Prof. A. G. Green.

16 Nov. 1904.

manufacture; that will vary with the different Works, and only the manufacturer himself can tell you what he loses.

359. In the completed product the alcohol is incorporated as a constituent, is it not, and could not be regenerated?—It could not be regenerated; it could be got out by chemical means, but not practically.

360. (*Mr. Tyrer.*) And such chemical means would be more expensive in the end than the alcohol employed?—It would be far more expensive than the alcohol employed.

Antipyrine. *See also* Qs. 476–498.

361. (*Chairman.*) I see you give an instance of very large profits made out of one of these preparations by the patentees?—Yes. I have instanced antipyrine, upon which a very large profit was made at one time. I think £60,000 a year was made by Messrs. Meister, Lucius and Brüning, the patentees, for several years while the patent ran. The patent has now expired, and it is quite probable that English manufacturers would take up the manufacture of that product, as it is a profitable product, if they could have alcohol sufficiently pure and sufficiently low-priced. Alcohol is by far the most important constituent in that compound.

362. Are none of the substances in these two tables produced in this country at all?—It is difficult to say that none of them is, but I should say that practically there is none—at any rate, there are very few indeed.

363. If alcohol enters to a very large extent into these preparations, then, quite apart from the duty, a substantial difference in the price of the alcohol as, for instance, the difference between the price of methylated spirit and unmethylated spirit, would of itself, I suppose, be a heavy handicap against them?—It would be a handicap, undoubtedly, but not quite so heavy a handicap as in the case of the colouring matters. These pharmaceutical products are produced in smaller quantities and bear higher profits. They are not cut quite so fine, and the competition is not so keen, as in the case of the colouring matters. Consequently, the difference in the price of alcohol would not be of the same weight as in the case of the colouring matters, but it must be a handicap always.

364. Taking antipyrine, would the wood naphtha in the methylated spirit be perceptible in the finished product, if you used methylated spirit?—Yes; it is not so much the methyl alcohol in the methylated spirit which is objectionable, but the other impurities—the acetones and so on—which are present and which would be very detrimental indeed.

Phenacetin.

365. (*Mr. Tyrer.*) Are you aware that phenacetin at the present moment is 2s. 9d. per lb. in England?—Yes.

366. And that in New York—in America generally, in fact—it is 16s.?—Yes.

367. That shows the value of patents and protection. Taking 2s. 9d. as the price at which we should have to compete here for the purposes of sending to our colonies in competition with the present makers, the Elberfeld people, I think, what would be the quantity of alcohol there?—When the price is as low as 2s. 9d. a difference in the price of alcohol of between 10d. and 1s. 4d. per gallon would be very material, that is to say, it might prevent the English manufacturer from competing.

368. I put that question in consequence of your observation that the high prices of these pharmaceutical products would probably give a larger profit, and therefore the question of the cost of the alcohol would be relatively of rather less importance in regard to them. Would you not say that that observation of yours has to be modified in view of these rather singular facts?—I spoke, of course, in general, and there must be exceptions to that where the competition is much keener.

Synthetic Perfumes.

High price of alcohol in United Kingdom a disadvantage but not prohibitive.

369. (*Chairman.*) Have you anything that you would like to say to us upon the subject of the synthetic perfumes?—Yes, I have put a few notes together with regard to that which I should like to lay before you. The manufacture of odoriferous substances intended for use as perfumes from organic materials by synthetic means is an industry which has attained large proportions in Germany and Switzerland, but which at present is absolutely excluded from this country. The manufacture of "synthetic perfumes" must be clearly distinguished from that of "compounded perfumes." I refer to that because of the correspondence between the Manchester Chamber of Commerce and the Chancellor of the Exchequer, in which the Chancellor of the Exchequer misunderstood the meaning of the Manchester Chamber of Commerce. In the former case (synthetic perfumes) alcohol enters into the constitution of the odoriferous substance, or is employed as a solvent in its manufacture: In the latter case (the compounded perfumes, which are largely made in this country, and in regard to which the law is quite satisfactory) the alcohol is used as a solvent for the odoriferous substances which are compounded together and sold in alcoholic solution as a "perfume." The odoriferous substances employed for this purpose may be either natural products or artificial. A few of the most important artificial odoriferous substances or so-called "synthetic perfumes," in the manufacture of which pure alcohol is a necessary ingredient, are the following: Vanilline, heliotropine, artificial musk, ionone or violet essence, artificial oil of neroli, geraniol, artificial jasmine oil, and a number of others. These substances are largely used by perfumers, by soap makers, and, curiously enough, by flower dealers—they are used for scenting natural flowers and also for scenting artificial flowers.

370. In those cases, is the quantity of alcohol large in proportion to the other materials?—Yes, the alcohol in many of these cases is a very important ingredient, either in regard to its use as a solvent, or in regard to its absolutely entering into the compound.

371. Are they to a certain extent what you may call rather fancy articles on which there is a considerable margin of profit?—Yes, I should say there is a considerable margin of profit on those articles. It is a fairly profitable industry.

372. So that in respect of those a comparatively slight difference in the price of the alcohol would perhaps not be so great a disadvantage as to be prohibitive?—It would not be absolutely prohibitive, but it certainly would be a disadvantage, because one cannot regard the difference between 10d. and 1s. 4d. per gallon as a slight difference—it is a very material difference.

373. Of course the extent to which it is a material difference depends very much upon the quantity of gallons you require for a given quantity of a given article?—Undoubtedly, and also upon what is the margin of profit on the article you are manufacturing.

Alcohol at German price and with minimum of restrictions a necessity for development of British industries.

374. In the last paragraph of your *précis* you speak of the stimulus which would be lent to the opening up of new industries and improved processes, if manufacturers had at their disposal pure spirit at as low a price as it is obtained in Germany. Is that purely general, or have you got in your mind any particular industries or processes which at this moment are in existence elsewhere, but not in this country, which might be introduced into this country?—No, I simply look upon it as being a very important matter in regard to commercial development, commercial enterprise, and commercial research and investigations in general. At the present time the manufacturer is practically debarred from the use of alcohol. He can only have it if he proves that the industry which he proposes to go into is a very important one, and if he agrees to a lot of conditions which, as a rule, are very vexatious. These conditions prevent him from practically considering it, and he looks upon alcohol as a thing outside his purview. I think the manufacturer should feel that pure alcohol is a cheap raw product having nearly as many uses and possibilities as benzol.

375. You say that he is hampered by numbers of restrictions and so on; after all, our experience of what might be done with pure spirit—that is, spirit other than methylated spirit—is of only two years' duration, though for the last fifty years people have been able to use duty-free spirit subject to certain conditions—namely, that it should be in a particular form—methylated spirit?—Yes, quite so.

376. In 1902 we relaxed that, and instead of having the one and only condition that it must be methylated spirit, the Board of Inland Revenue were given power to allow spirit to be used on other conditions, and even, in the last resort, to be used absolutely pure. Our experience of that is, as I say, only two years old. Has any case come under your notice where during the last two years people have made application to use duty-free spirit in

virtue of the Act of 1902 and have been deterred by the conditions which the Board of Inland Revenue have attached to its use ?—I know of no case which has been brought to my personal knowledge.

377. (*Mr. Tyrer.*) All the way through, in thinking of what has been accomplished in Germany and what might have been accomplished here, you are thinking of spirit at something approaching the German price, are you not ?—I am ; I think under the present conditions it is hopeless for the English manufacturer to attempt to compete in these alcoholic products, unless he has spirit at the same price that they have it in Germany. The present conditions will also be a bar to the progress of any new industry which might come forward, unless the spirit is as cheap here as it is in Germany.

Chemical Education in United Kingdom as compared with Germany. Supply of capable chemists would meet a demand.

378. I will now ask you the question which I have put to one of your predecessors as a witness : Assuming we had cheaper alcohol, are our chemists sufficiently educated to be fit to aid the preliminary work of research and the work afterwards—comparing them with our German friends ?—I think so. You must remember also that we have a very large number of German chemists employed in this country.

379. I am not thinking of the German chemists, but I am thinking of those who have been turned out from our schools of late years ?—The standard of chemists turned out from our schools is, of course, improving. I cannot say that at the present time it is quite up to the standard of the German schools, but I do not think that that is a material factor. I think that the supply will certainly meet the demand, and that if there is a demand for a better class of chemists, they will be forthcoming.

380. You think, then, that if industrial facilities exist, a demand for research chemists of the kind suited for that particular work would soon arise ?—I do.

381. In other words, if there is a demand for the work the research would follow ?—Yes. If the organic chemical industries were in a better position in this country, there would be a much greater demand for trained organic chemists.

382. And the supply would be there from our schools ?—The supply would quickly come.

Excise supervision broad.

383. Do you know anything of your own knowledge, or at any rate by report, sufficiently reliable as to the amount of supervision in the control of the spirit used in industrial establishments on the Continent?—I have heard, of course, a certain amount with regard to it, but I could not speak of my own knowledge on that point.

384. Have you heard that it is effective ?—I believe it is quite effective.

385. And not very elaborate ?—No, it is not very elaborate. There are no great difficulties put in the way of the manufacturers.

386. Have you heard whether it is strict ?—What do you mean by "strict" ? The revenue is strictly protected.

387. Certainly, it would be, but, of course, the difference is enormous between their comparatively low price and the high duty that we have, and therefore supervision, put in terms of £. s. d., is not relatively as important there as it is here. Nevertheless supervision may be strict, and I am asking you whether it is strict enough—it certainly is strict enough or else they would not keep it on—but is it strict enough compared with what we might want here ? —I should say it is not vexatious. I should say that every gallon of the spirit must be accounted for. That presents no difficulties for any well-conducted works where not only every gallon of spirit, but every pound of aniline and every pound of other material is strictly accounted for. The manufacturing books should show every pound of every kind of material that is used, and should give you an absolute balance showing so many pounds of, say aniline bought, and so many pounds of aniline used for everything, and so on with every raw material that is employed. There is no difficulty for the German manufacturer or for any manufacturer who keeps his books properly, in keeping an absolute record of the quantity of spirit he uses. He should be able to say at the end of each half year," "There ought to be so much spirit here ;" and if it is not so, where has it gone to ?

388. In other words, the system which is observed in any industrial establishment which is worthy of the name, could be equally applied to a manufacturer and should be applied to a manufacturer, who used expensive materials as well as cheap ones ?—Undoubtedly.

389. If they know their business, the system should be equally applicable to both classes of material ?—Certainly.

Concessions by Board of Inland Revenue to Clayton Aniline Co. in 1894 and 1897 for purpose of making dimethyl aniline (*See* Qs. 318–21) not followed up, though they admittedly met the requirements of the Company. The reasons for this.

390. (*Dr. Thorpe.*) You have made allusion to the application of the Clayton Aniline Company to use duty-free methyl alcohol ; that application was first made, I think, in 1894, when you were not in the employment of the company ?—I was not in their employment at that date.

391. In 1894, I find from the minute furnished to me, that the Clayton Aniline Company, Limited, were allowed to import methyl alcohol for experiments in making aniline dyes and dimethyl aniline under Treasury sanction on payment of the surtax only ; you have no personal knowledge of that fact ?—No.

392. In 1897, when you were a chemist to the company, the Clayton Aniline Company were allowed by the Board to use duty-free methyl alcohol for the manufacture of these substances, on condition that such alcohol was mixed with one-twentieth of 1 per cent. of mineral naphtha—a condition which the company stated would suit their purposes quite well. Were you aware of that fact ?—Yes

393. I think we personally arranged that condition ?—Yes, we did. I made the experiments myself with the material, and I found it quite satisfactory for the purpose.

394. You have told the Committee that your company did not avail themselves of this concession ?—No. they did not.

395. You made no further application for permission to use methyl alcohol ?—No.

396. Would you kindly tell the Committee why you found it inexpedient to take advantage of this concession ?—It is difficult to say why the board would not do so. I pressed the matter on them. I considered that with that concession and with the price of dimethyl aniline then ruling, there was a substantial profit to be made upon the manufacture of dimethyl aniline. From that point of view I pressed the managing director to start the manufacture, but after considering it, they decided not to do so—I believe because they felt there was not sufficient profit.

397. Your object was solely to make dimethyl aniline ? —Yes. That is, of course, a raw product for a large number of the colouring matters.

398. Dimethyl aniline, I suppose, at that time was made largely as a product indirectly obtained by the distillation of beetroot residues ?—No.

399. Then how is the dimethyl aniline which you imported obtained ?—It is made by the methylation of aniline—by heating aniline with methyl alcohol from purified wood spirit and hydrochloric acid.

400. Was it not made from the chloride obtained from methylamine ?—No.

401. In no case ?—It is difficult to say, but I scarcely think any of it was made in that way.

402. Was not the chloride of methyl obtained from methylamine, which was itself obtained by the distillation of vinasse ?—I think it was used as a methylating agent in a number of cases—for methylating phenols, for instance for the manufacture of dianisidine. For the making of dianisidine you would require a methyl chloride or a methyl acid sulphate.

403. And these substances are themselves obtained from vinasse, are they not ?—Methyl chloride is obtained from vinasse, but not entirely. I think there is a considerable amount of methyl chloride which is made from methyl alcohol.

Vinasse.

404. Has not the fact that there is a considerable quantity of methyl chloride to be obtained from vinasse had its effect upon the price of dimethyl aniline ?—I do not think so. I think that practically the whole of the dimethyl aniline made at the present day, and probably all that was made at that date also, was made from methyl alcohol and not from vinasse.

Q. 326.

405. You have given us a table which shows a number of dyes, the names of which are given, into the composition

Prof. A. G. Green.

16 Nov. 1904.

of which either methyl alcohol or ethyl alcohol enters; and you said that those which you gave in the table are among the most important brands. May we take it that the table substantially enumerates the important dyes in which these alcohol radicals function?—No. The table only gives a few cases. I have taken the most important of them, but there might be three or four times as many.

406. What do you mean by the most important relatively? If you were asked to name those which are the most commercially important substances, would you name those that are given in this table?—Yes, rhodamine, methyl violet, and so on; but it is not in any way a complete list.

407. Why, having the facility of using methyl alcohol duty free, did not your firm attempt to manufacture any of those in which methyl alcohol functions?—It is difficult to say. They would not take up the manufacture of the dimethyl aniline which, of course, is the raw product in the manufacture of all these colours into which methyl alcohol enters.

408. Although they could have had the methyl alcohol duty free?—Although they had the facility for doing it, they did not care to enter into the business at that date.

409. They had every opportunity and every concession which the Exise and the Government could give them, and yet they could not make those things?—Yet they did not make them. They could have made the raw products, I think. Whether they could have made those profitably or not is another matter; but they would not have been deterred, at any rate, by the alcohol question alone.

410. Nevertheless they did not make them?—They did not make them.

411. (*Mr. Tyrer.*) Contrary to your advice?—Yes, contrary to my advice.

412. (*Dr. Thorpe.*) I suppose they were furnished with, or had the means of furnishing themselves with, information as to the cost of making these articles?—That would go through me.

413. I suppose the margin of difference was not sufficient to invite them to go on?—It did not invite them apparently; it did not tempt them.

Allegation that Revenue restrictions in use of alcohol have caused the decadence of the British aniline dye industry cannot be maintained.

414. I think no one better than you could give this Committee an accurate idea of the relation in which alcohol stands to this industry; and no one, I think, better than you could tell us precisely what is the value of the allegation that it is the restrictions on the use of alcohol which have practically killed the aniline industry in this country?—It cannot be maintained for a moment.

415. What cannot be maintained?—Such a statement as that could not possibly be maintained, and I have never heard it put forward.

416. You yourself, of course, have not put it forward, but has it not been put forward?—I hardly think it has in such bald terms—such strong language as that.

417. There are present Members of the House of Commons, and I have not the least doubt that they could tell us how far the statement has been made that it is the fiscal restrictions on the use of alcohol which have practically killed what would have been a flourishing industry in this country?—At any rate, that is not my view of it. It is undoubted that the restriction on the use of alcohol is a deterrent and has been a hindrance to the English manufacturer; and this hindrance, together with other hindrances, such as our patent laws, may have helped towards preventing the development of the colour industry in this country. But I do not think that all those things put together are as important as other considerations in regard to the want of technical knowledge and appreciation of science on the part of manufacturers themselves, which is the most important thing in connection with this question. At the same time, I think the alcohol difficulty must be considered as having played some part in the matter. It has prevented a certain number of colouring matters from being manufactured; but then, of course, alcoholic colouring matters after all are only a fraction of the whole. I am not able to say exactly what fraction they are, but perhaps they may be a third of the number.

Real cause of decadence has been the want of technical knowledge and the unscientific attitude of manufacturers. (*See* also Qs. 499–500).

418. We will come to that in a few moments, if you will allow me. You are credited as being the author of the statement that the British manufacturer cares more for the benzol market than he does for the benzol theory; does that represent precisely your view?—I do not say it is at present the attitude, but it has been the attitude in the past.

True place of alcohol in the coal-tar industry as deduced from witness's book.

419. You are the author of a book which I am not going to flatter you by saying is a classic in the literature of the coal-tar industry, namely, the work which is entitled "A systematic survey of the Organic Colouring Matters." That is a book which is founded upon the well-known tables of Schultz and Julius, and you have been at considerable pains to bring that work up to date?—Yes.

420. The edition before me is the second edition, and it is issued in this year of 1904. We may take it, therefore, that you have striven to make this book an accurate reflex of the present condition of the aniline dye industry in the world?—That is so.

421. I think from this book we can obtain a measure of the importance of alcohol in the manufacture of these articles, can we not?—Undoubtedly.

422. By means of this book, supplemented, of course, by the information which you now give to the Committee, I think the Committee will be fairly accurately informed on the precise relation of this material to the industry?—Certainly.

(1) In raw material alcohol has no part.

423. Now, you have divided your work systematically under the heads, first, of the raw materials, next, of the intermediate products, and thirdly, of the finished products in this manufacture?—Yes, that is so.

424. Of course, as regards the raw materials, alcohol plays no part?—Except as alcohol.

425. It is not mentioned?—I think you will find towards the end of the raw materials it is mentioned—not as a raw material but as an intermediate product.

426. You will find methyl alcohol, but ethyl alcohol is, very curiously, not mentioned at all?—That is rather a curious omission.

427. Let us take the book as it stands. There are, I think, some nine raw materials enumerated—benzene, toluene, xylene, naphthalene, anthracene, phenanthrene, phenol, cresol, and pyridine. Alcohol plays no part in the formation of any of these things?—That is so.

428. Then you enumerate some 300 intermediate products?—Yes.

(2) Intermediate products. Numbers and importance of those containing alcohol radicle.

429. I have had the curiosity to go through the whole of that list of intermediate products, and to find out precisely into how many of them, as primary intermediate products, either methyl or ethyl alcohol functions. You, perhaps, could not tax your memory sufficiently to say whether my list is accurate, but I will read it as I have found it. I have found that of the 300 intermediate products there are 18 primary products into which the ethyl or methyl radicle enters, or in the preparation of which ethyl or methyl alcohol is directly or indirectly concerned?—Are you allowing for cases like resorcin where an extraction is necessary by means of ether.

430. I will read you the names and you will tell me how far I am correct. I have found that there are 10 methyl compounds and 8 ethyl compounds. Take first the methyl compounds, they are cumidine; ortho-anisidine; amido-beta-naphthol methyl ether; mono-methylaniline; dimethylaniline; methyl-o-toluidine; methyldiphenylamine; dimethyl-alpha-naphthylamine; methylphenyl-alpha-naphthylamine; dimethyl sulphate; formaldehyde and methyl chloride. Those, with the addition of methyl alcohol itself, are all the methyl derivatives that I can find any notice of as primary intermediate products?—You should add resorcin, in which ether is used.

430*a*. The solvents stand in a somewhat different category to the constitutional ethyl or methyl, as they may be recovered to a greater or less extent and used over and over again. The substances for which alcohol or ether are used as solvents are, I believe: Resorcin, benzidine, toluidine, diamidostilbene, m-amidophenol?—Yes.

431. In the list I have just given you I was only dealing with the methyl compounds. Now I come to the ethyl compounds. They are ethyl bromide, monoethylaniline, diethylaniline, etyhl-o-toluidine, alpha-amido-beta-naphthol ethyl ether; acetoacetic ether; oxalacetic

ether, and quinaldine ?—Yes, I presume you are correct, but I cannot check it here.

432. Then out of the list of your intermediate products there are about twenty primary intermediate products in which the ethyl or methyl radicle functions ?—Yes, that may be true, but I hardly think you can count these bodies as all of equal importance. The importance of a body like dimethylaniline may be a hundred times greater than the importance of some of the things you have not mentioned, because alcohol does not enter into them. Moreover, in addition to the primary intermediate products which you have mentioned, there are also a large number of secondary intermediate products containing methyl or ethyl radicles which are derived from the primary products, but which I admit contain no further quantity of ethyl or methyl than is already contained in the primary products, just as many of the non-alcoholic products are derived from others.

433. I make no reflection on that, because I have no means of exactly knowing their relative importance ?—You simply take it on the question of the numbers ?

434. I simply take it on the fact of the particular radicals being there. I am quite aware with you that some of these things, although mentioned, are of very subordinate importance ?—Many of them are, of course.

435. In fact, I venture to say more than half of them are of very subordinate importance ?—Undoubtedly.

436. It merely strengthens my argument that, as a matter of fact, these alcohol radicals do play, relatively, a very subordinate part in the creation of the materials with which you have to deal ?—I do not think that their relative importance could quite be measured by these numbers. I fancy that most of the alcoholic preparations are more important. In a great many cases these alcoholic preparations are extremely important, whereas many of the non-alcoholic preparations are not of the same importance.

437. As you know, I could get from the list of intermediate products articles which, as regards the amounts in which they are used, and the part which they play in the industry, are infinitely more important than a number of these alcoholic preparations ?—You mean from the non-alcoholic preparations ?

438. Yes; from the 270 others I could quote instances which are infinitely more important than any alcohol derivative I have mentioned ?—I hardly think that. Beta-naphthol would be one of the most important non-alcoholic preparations; and you would compare, perhaps, beta-naphthol with di-methyl aniline. It is true that beta-naphthol is used in greater quantities than di-methyl aniline, but you could not say that it was infinitely more important.

439. In the extent to which it is used it is more important ?—Undoubtedly it is more important, but it is difficult to say to what extent.

(3) Finished dye-stuffs containing alcohol. Estimate of the value per cent. of the whole.

440. Anyhow, I think we have got the measure at all events of the amount to which alcohol functions in these intermediate products. Now we come to the dye-stuffs themselves which these intermediate products are used to build up. You enumerate in your book 711 different coal-tar dye-stuffs, do you not ?—Yes.

441. You have dropped out of your tables some which are obsolete ?—Yes.

442. So far as you know, those 711 fairly accurately cover the ground ?—Fairly, of course.

443. You say in your preface, and naturally so, that there must be some of which you can have no knowledge ?—Yes.

444. And there are one or two which you have mentioned which must be taken as types of others ?—Yes.

445. Still, we may take it that in substance your enumeration is a fairly accurate synoptical statement of the present condition of the manufacture ?—Yes.

446. As regards these dye-stuffs, I have taken the pains to subdivide them under the headings that you give. You have already given the Committee a certain amount of information, and anticipated thereby a question which I was going to ask you. The largest number of these dye stuffs are comprised in the group of the azo colouring matter are they not ?—Yes, by far.

Azo-dyes.

447. The total number of the azo colouring matters out of the 711 that you give is something like 383 ?—Yes. *Prof. A. G. Green.*

448. You have told the Committee that substantially alcohol does not play any part in the formation of the azo-dyes ?—With the exception of a small number. 16 Nov. 1904.

449. May we take it that what you have given in one of the tables you have put in enumerates the number of the 711 dye-stuffs in which alcohol, either methyl or ethyl, functions in these things ?—It is not a complete list: it gives some of the more important ones. (*See* statement A, page 22).

450. You gave us first a list which you stated enumerated only the most important brands ?—And the other is not a complete list either, by any means. It is only intended to indicate some of the more important ones.

451. For practical purposes, looking at the thing broadly as answering our questions, is it substantially complete ?—It contains the names of the more important alcoholic colouring matters.

452. That is, the more commercially important alcoholic colouring matters ?—Yes.

453. Would you kindly tell us in the first place what is the relative importance of the enumeration there, and in the next place what, broadly speaking, would be the proportion in output of those dyes to the total output ?—Taken in values ?

454. I should like it in the first place in weight, if you can give it me in that form ?—I am afraid I cannot do that. It is an extremely difficult thing to estimate. As you know, there are no statistics published with regard to these things.

455. Is it 1 per cent ?—It is much more than that.

456. Is it 5 per cent. ?—I should say it was nearly 20 per cent. It would be something perhaps between 20 and 25 per cent.

457. A quarter of the whole ?—It might be—certainly 20 per cent.

458. Then comparatively few substances make a fifth of the weights of the whole 711 ?—If you will look at the first table I put in you will see what big quantities those colours are selling in. We were speaking about the azo colouring matters in which alcohol enters; so take chrysophenine, which is one of the few cases in which it does. That dye-stuff is at the present time by far the most important of all the direct yellow dye-stuffs for cotton. (*See* Q. 326).

459. And with the exception of Victoria Blue R. it is the lowest of the whole series you have given in the amount or proportion of the alcohol radicle ?—Yes, it is the lowest.

460. (*Sir W. H. Holland.*) Is that made in this country, might I ask ?—No, there is none of it made in this country. Tartrazine again and auramine are used in pretty considerable quantities.

461. (*Dr. Thorpe.*) Which auramine, O. or G. ?—Both.

462. Auramine O. is a purely methyl derivative, is it not ?—Auramine O. is a methyl derivative, and auramine G. is an ethyl derivative.

463. And auramine G. is not mentioned in this table ?—It may not be down, but it is used.

464. However, the point is this, do you maintain your statement that 20 per cent. of the dyes which are made—one-fifth of the 711 dyes which you enumerate—contain methyl and ethyl derivatives ?—It is an extremely difficult thing to give a positive statement upon. I should not like to venture a positive statement; but if I was asked simply for my opinion I should say about 20 to 25 per cent. But I should not like to give a positive opinion upon the point without having definite statistics to go upon.

465. It would weary the Committee, but nevertheless I could take you through, I do not say the 711, but through every one of the groups under which they are classified, and put similar questions to you ?—Of course, most of the alcoholic preparations are basic.

466. I am afraid I cannot get you any further than that you say, in your opinion at least one-fifth of these dyes are alcoholic ?—Yes.

467. Do you mean one-fifth in value contains alcohol ?—I should say one-fifth of the total value either contains

Prof. A. G. Green.

16 Nov. 1904.

alcohol or alcohol is somewhere used in its manufacture. Take, for instance, the resorcin colouring matters; alcohol will enter into the resorcin constituent as a means of extracting the resorcin from ether.

468. You were at one time, you told us, in the employment of Brooke, Simpson & Spiller?—Yes, for nine years.

469. When you were there, did the question of the employment of alcohol ever become of importance?—I think that the question was raised on one or two occasions.

470. What do you mean by "raised"; was there any correspondence with this department?—I think there was some correspondence with the Board of Inland Revenue. I remember some correspondence in regard to the question of a methylating agent—whether they could be granted permission to use some other methylating agent than ordinary methyl alcohol.

471. Was it, so far as you know, a real, practical necessity for you then; was it seriously interfering with your operations as you then carried them out?—None of the products which they were then manufacturing were alcoholic colouring matters. In fact, I may say there are very few alcoholic colouring matters made in this country at all. It has not been possible to make them.

472. Although they have the use of methyl alcohol duty-free?—That has only been of late.

473. Since 1897?—That permission was only given to one firm.

Qs. 390-413.

474. There is no particular reason for withholding it to any other firm who ask; it was a matter of public notoriety that it was granted to the Clayton Aniline Company?—Was it?

475. It was mentioned in the discussions of the Society of Chemical Industry, and it has been more than once quoted in print; so it is pretty well known?—I think it has only become known recently. I do not think it was known generally at the time, nor for a good long time afterwards.

Antipyrine: (*See* Q. 361-4) No fiscal objection to its manufacture in this country if acetic ether were used as denaturant for making aceto-acetic ether.

476. You say that aceto-acetic ether is necessary in the manufacture of antipyrine, and that persons would make it, in your opinion—you say certainly would without any hesitation—if they could get acetic ether at practically its short price, as we say—that is, without the duty. In what way does acetic ether function in the manufacture of antipyrine?—In the manufacture of aceto-acetic ether.

477. Of course I know that, but how does the aceto-acetic ether function in the manufacture of antipyrine?—Antipyrine is the methylated condensation product of phenyl hydrazine and aceto-acetic ether.

478. Aceto-acetic ether could be made for such a purpose from methylated spirit, could it not?—I think not.

479. Could not the acetic ether required for conversion into aceto-acetic ether be made from methylated spirit?—Acetic ether in a pure state cannot be made from methylated spirit.

480. I am not talking about a pure state; I am talking about the commercial state?—It is necessary that it should be in a pure state.

481. Why is it necessary?—Because you would not get a satisfactory yield nor a satisfactory product if you tried to make aceto-acetic ether from crude acetic ether you want for that purpose pure acetic ether.

482. What is there in methylated spirit which would prevent the formation of commercially pure aceto-acetic ether?—There is the methyl alcohol and the acetones.

483. What proportion of methyl alcohol is there in methylated spirit?—I suppose you would take it on the 10 per cent. of wood spirit, and then there would be somewhere about 7 per cent. of methyl alcohol and about 3 per cent. of acetones.

484. Does not the methyl alcohol amount to more than seven-tenths of the wood naphtha?—I do not know exactly the percentage, but there is a very large percentage of acetones in crude wood naphtha.

485. That is a matter entirely within the control of the methylator; there is no obligation to use such an amount of acetones?—I thought there was an obligation to use a crude wood naphtha which contained a considerable amount of acetones and ketones.

486. Are you aware of the regulations which have been laid down as to the selection of the wood naphtha which may be used?—I think I have had the regulations, but I do not remember them at the moment.

487. Do they not define very accurately the amount of methyl alcohol and of acetone and of the other substances which may be used?—I believe they do, but I no not remember the amount.

488. There is no obligation to have three-tenths of the amount acetone?—Perhaps not.

489. Therefore, it is a matter which in that respect is entirely under the control of the user?—I take it there is an obligation that there should be a considerable quantity of acetone in the wood spirit.

490. There need not be a considerable quantity at all?—Obviously, if one used a wood spirit which was practically pure methyl alcohol, the product would be potable. A methylated spirit made with pure mythyl alcohol or anything like pure methyl alcohol may be potable.

491. You are now entering upon the general question, but you are aware what the object of the Government is—it is two-fold. In the first place, the object is to render the spirit non-potable, and in the next place it is to ear-mark the spirit?—Yes, that is so.

492. It is necessary for us to take measures, not only to render the article non-potable, but to be assured that it is exempt from duty; and the methyl alcohol is the index of that?—Yes.

493. If our conditions secure that, we have secured one part of the object of methylation?—Yes.

494. When chemically manufacturing it, it might be possible to secure the ear-marking without at the same time securing to the same extent the non-potability?—Yes, undoubtedly.

495. Therefore, supposing we wanted to use what we call ear-marked spirit for the manufacture of aceto-acetic ether, could we not do that?—You might certainly ear-mark it with acetic ether by adding acetic ether to your spirit. That would be absolutely satisfactory to the manufacturer of aceto-acetic ether.

496. It would be quite possible for anybody to make application to the Board of Inland Revenue under the present system and ask to have the spirit so ear-marked, would it not?—I take it that it would.

497. There is, therefore, no fiscal objection to the manufacture of antipyrine?—Not if the regulations are satisfactory regulations for the manufacturer.

498. The regulations of 1902 still exist, and if a manufacturer of antipyrine came to the Board of Inland Revenue and said, "Allow me to ear-mark the spirit with acetic ether," the Board, if they found that was a sufficient ear-marking, would raise no objection to it under their present system. Therefore, what objection exists to the manufacture of antipyrine?—If that were allowed and the other conditions were not vexatious, I cannot say that there would be any, under those circumstances.

Real cause of decay of English aniline dye industry—the want of scientific spirit in manufacturers. *See also* Qs. 417-8.

499. Now, perhaps, you will kindly tell us, as shortly as you can, what, in your judgment—I am sure no one is better able to give us an opinion—is the real cause why the aniline dye industry has left this country?—I think the cause is, as I have indicated in the report I made to the British Association, want of appreciation of Science on the part of our manufacturers in the past. They did not realise the great importance of investigations; the great importance of research; the great importance of theory. They expected to see an immediate result from experiments, and if they did not get an immediate result they considered that they were wasting their money. They did not employ a sufficient number of research chemists, and they did not pay those research chemists sufficiently to encourage them to remain with them. That, I consider, is the main cause. There may be other contributory causes, such as the patent laws and this question of the spirit.

500. In your judgment, the main factor is that which you have stated?—In my opinion, the main factor is as I have stated.

501. (*Mr. Tyrer.*) While making that statement very definitely, you give a share—I will not say you minimize

it—to the place which alcohol holds in regard to that industry, and the fact that if alcohol were in any way made cheaper and its price approximated more to the German price, and the other conditions were also fulfilled, the industry here would certainly be in a different position to what it is ?—I look upon it as a disability which I think could be removed here, and should be removed.

502. Dr. Thorpe has asked you some questions based upon your own book, which, I may take the opportunity of saying, I have studied and found in it pretty much the same as he did. The direction of his inquiries and your answers, as far as I followed them, was that even you were unaware that the attitude of the Department was so reasonable as it is; that the facilities which it has been popularly assumed—I use the word "popularly" in a limited sense—would be probably refused, if they were asked, were never asked for, and therefore, were never granted. You did not know yourself that some of these facilities existed, particularly the last one that you discussed—namely, the aceto-acetic ether business ?—No, I did not know that existed. I knew that the Board had met an application in regard to methyl alcohol of the Clayton Anniline Company in a very liberal spirit. That I was quite aware of. As I think I have stated to you in correspondence, I considered that the facilities which were given in that respect were absolutely satisfactory, and if they had been given earlier would probably have enabled the manufacture to have been taken up years and years ago.

Prospects of recovery with present facilities.

503-4. (*Dr. Thorpe.*) They were given when they were asked for; they were given as far back as 1894 ?—I do not know that they were not asked for earlier, but they may have been asked for earlier. I think it is possible you might give every facility now and yet you might not be able to bring back the industry or the manufacture of these particular colouring matters which has been lost for the want of these facilities in the past. It is not an easy thing to introduce anew a manufacture that has been lost to a country.

Purity of spirit required for making colours.

505. (*Mr. Nicholson.*) With reference to the alcohol which you are desirous should be generally used, is it essential that it should be very pure ?—It depends upon the purpose for which it is used. For many purposes it suffices if the alcohol is 95 per cent. or something of that sort—perhaps even 90 per cent.; but for many purposes also you require absolute alcohol. The manufacturer himself of course can make it absolute if he wants to.

506. I do not mean to put to you the question of the water, I am merely putting a question of the purity of the alcohol. You want pure ethyl alcohol ?—Yes, we do.

507. (*Dr. Thorpe.*) Do you mean pure ethyl alcohol in the ordinary accepted commercial sense ?—Yes.

Special denaturants suggested for aniline dye industry. *See* Q. 342.

508. (*Dr. Somerville.*) Might I ask you whether you could give to the committee the names of the substances that you would suggest as denaturing agents, as alternative to the wood naptha ?—Yes, I think I could. Special circumstances, of course, would require special denaturing agents, but I could indicate one or two general things of that sort which could, perhaps, be used in certain cases. I think that the proposal made by the Board of using one-twentieth of 1 per cent. petroleum with methyl alcohol, would do equally well with ethyl alcohol, and would be quite satisfactory when the alcohol had to be used for the manufacture of colouring matters.

Petroleum.

509. From the technical point of view, that is, from the point of view of the manufacturer, would that denaturing agent be open to any objection ?—I think not. I think that would be quite satisfactory. For many other purposes I think a small addition of pyridine, as employed by the German Government, would be satisfactory—but the less the better.

Pyridine.

510. (*Mr. Nicholson.*) The additional cost would be inconsiderable, would it not ?—It would be quite inconsiderable; in fact it would not affect the cost of the spirit.

511. (*Dr. Somerville.*) You have mentioned two substances; perhaps you could mention others ?—In special cases one could use the product which one was going to manufacture; for instance, if you were making acetic ether, you could add acetic ether to the alcohol.

512. Would the addition of acetic ether to alcohol not set up chemical re-action forthwith ?—No, not at all.

513. (*Chairman.*) None of those methods of denaturing would be so permanently effective that it could be used for spirits which were allowed to move about the world unattended so to speak ?—No.

514. I take it that in either of those cases the spirit could without much difficulty be re-purified ?—Yes.

515. Therefore you are not offering these methods of denaturing as alternatives for the process of methylation in the legal sense, but merely as processes that could be applied in particular cases where the spirit would be under a certain amount of supervision ?—Yes.

516. No one has really yet suggested anything which is permanently effective, except wood naphtha ?—There is pyridine.

517. Would you say that the traces of pyridine cannot be removed ?—Pyridine is somewhat difficult to remove, but it can be removed. Pyridine is used I think by the German Government.

518. What advantage would that have over wood naphtha ?—A much smaller quantity could be used.

Finished colours—different shades according as ethyl or methyl alcohol is used.

519. (*Dr. Somerville.*) According to one of the tables which you have handed in (*see* table on p. 14, Q. 326), you seem to indicate that for the production of certain colours it is a matter of indifference to the manufacturer whether he uses methyl alcohol or ethyl alcohol ?—Not when it enters into the composition of the colour, because it will make a difference in the shade of the colour whether methyl alcohol or ethyl alcohol is used.

520. You specifically mentioned auramine O and auramine G. Do I understand that those two auramines are not of the same colour, and therefore do not produce the same result ?—That is so; auramine G is a much greener shade of yellow than auramine O, the difference in constitution being that auramine G contains ethyl alcohol and auramine O contains methyl alcohol.

521. When you say that one alcohol may be substituted for another, is that only when the alcohol is used as a solvent ?—I think, perhaps, you misunderstood that sentence. I say in some cases one alcohol may be substituted for another—in the table I have only given one or two brands, but there may be many other brands, in some of which one alcohol functions and in some of which the other alcohol functions; and the proportions are different.

522. Where the two alcohol radicals are different, you practically get two distinct colours and not the same colours?—Yes, it makes a difference to the shade of the colour.

Prospects of revival in British Colour industry with duty-free methyl alcohol.

523. Then you are, I think, of opinion with others that the so-called aniline dye industry in this country has been on the down grade for some time ?—No doubt about it, unfortunately.

524. Does that apply to the aniline dyes which are prepared with ethyl alcohol as the radical, rather than to the dyes which are prepared with methyl alcohol as the radical ?—As none of these colours have been made in this country at all, practically, it is difficult to say. I think you are speaking only of colours ?

525. Yes ?—You can hardly say that the manufacture of those colours has been on the down grade, because it has never existed, and it has never grown up here; it is a tree which has never been planted.

526. With duty free methyl alcohol, is there any particular reason why we should not compete with the Germans if the other conditions were equal to those that prevail on the Continent ?—There is absolutely no reason why we should not compete, except the difficulty of starting a new industry.

Coal tar and its derivatives as raw material. Germany not now dependent on English supplies.

527. We have, I suppose, got more of the raw material in the shape of coal tar in this country than any other country in the world ?—We have a great quantity.

528. So that the essential raw material is here in abundance ?—Yes.

529. Do you know whether this raw material which is called coal tar is exported to the Continent in large quantities or not ?—I do not think there is any coal tar exported as such, or at any rate there is not much. It is mostly the hydro-carbons present in the coal tar that are exported.

Prof. A. G. Green.

16 Nov. 1904.

530. The hydro-carbons which are, in fact, the essential bases of these colours ?—Yes, that is it. There is a considerable amount of tar distillation done in England, and a certain proportion of the products obtained are exported. But the German manufacturers are not dependent now, as they were at one time, upon exportation from England.

531. Instead of exporting the coal tar, you say it is distilled ?—Yes.

532. And the hydro-carbons that come over in the process of distillation are exported ?—Yes.

533. And the other residues remain in this country ?—Yes.

534. I suppose that this distillation is undertaken in order to reduce the cost of the carriage of the essential bases of these dyes when these substances are taken abroad ?—Yes. Tar distillation has been a profitable industry; it has paid to distil tar.

Percentage of hydro-carbons produced from Coal Tar.

535. Could you give the Committee an approximation to the percentage of these hydro-carbons that would come off from ordinary coal tar ?—I think I can give you some idea, but you will find more definite information in my book. It is about 1 per cent. of benzol, about 5 per cent. of napthalene, and about ½ to 1 per cent. of anthracene.

536. Do you mean that the essential substances, so far as the colour is concerned in raw coal tar, only runs from 5 to 10 per cent. ?—Altogether there will not be more than that.

537. The point I was going to make was this, that if coal tar were exported from this country to the Continent in large quantity, or if the hydro-carbons that come off were exported in large quantity, the cost of carriage that must necessarily be incurred in connection with such exportation would have acted as a fair incentive, not to say bonus, to the manufacturers of this country to proceed with the manufacture of the colours at home in place of allowing the Germans to do it for us ?—The cost of the carriage would have been far greater if they had had to send the coal tar, than if they could, as they have done, send the products; because the important products do not amount to more than one-fifteenth or one-twentieth of the whole, so you would have had to send ten or twenty times as great a quantity.

538. Still, you think that the products which are sent out come to something like 5 or 6 per cent. of the total weight of the crude coal tar ?—They perhaps come to one-fifteenth, or something of that sort. It is not possible to give very exact numbers, because it is sometimes the pure hydrocarbons and sometimes mixtures of them, such as "napthas" and "light oils," that is half rectified products, which are exported. In the latter case the proportion of the original coal-tar which they form will be larger.

539. I think you have already said that you do not think a great quantity is exported now ?—Much less than there was, and of that which is exported you cannot say that the German manufacturers are dependent upon it. It is merely a question of where they can buy it cheapest. If they can buy it cheaper in England, they will do so. The market changes.

540. (*Sir W. H. Holland.*) May we take it that after all this cross-examination you are still of opinion that our regulations as to alcohol have practically the effect of prohibiting the manufacture of many articles in this country ?—Yes, I do think so. I think if the Board have been willing to grant facilities on easy terms manufacturers have not been aware of it. I think it should not be a privilege of the few, but a privilege which should be extended to all; and the facilities which are given should not be given with any vexatious restrictions or any expensive restrictions. The only thing that should be looked to is the proper protection of the Revenue. I do not think that the Revenue would be in any way placed in danger.

Excise restrictions regarded as practically prohibiting certain industries in United Kingdom.

541. If the trades are non-existent in this country at present, of course the removal of the duty would not affect the Revenue ?—No; but supposing such trades could be established, I cannot think that the Revenue would be affected in any way, because there would be no revenue from the alcohol used for manufacturing purposes in any case. It is impossible to use duty-paid alcohol for any manufacturing purpose.

542. If certain industries have been practically prohibited, that of course diminishes the employment of British labour ?—Exactly so.

543. And *pro tanto* increases the employment of foreign labour ?—Exactly so.

544. Do you know anything about the artificial silk industry ?—No, I do not. I have been informed that there was a large works which ceased work, but I could not speak to that personally, as I have no personal knowledge of that at all. I should like to add that a number of products employed in the manufacture of colouring-matters and medicinal agents require in their production the use as a solvent of pure ether at a low price. The ordinary ether manufactured from methylated spirit is both too dear and too impure. As instances of intermediate products in the manufacture of which ether plays an important part I may mention the following:—Resorcin, dimethyl-met-amido-phenol, diethyl-met-amido-phenol, mono-ethyl-met-amido-phenol, and others. Then I think it would be a very great gain to us if we had pure ether as well as pure alcohol in our research laboratories. It has been an immense advantage to us to be able to obtain pure alcohol for our laboratories.

Ether—its use in making medicinal agents and dyes. Methylated ether too dear and too impure.

545. (*Dr. Thorpe.*) Like Oliver Twist, you ask for more ?—Yes.

546. (*Chairman*) Could you give us any particulars of the consumption of alcohol in foreign colour works ?—Yes, I have the particulars of the consumption of alcohol in a few foreign colour works, the names of the firms being withheld by desire. Firm A used 1,250,000, litres of methyl and ethyl alcohol; Firm B used 3,000 kilos of alcohol; firm C 60,000 kilos of ethyl alcohol and 60,000 kilos of methyl alcohol; and firm D 30,000 kilos of ethyl alcohol and 50,000 kilos of methyl alcohol. According to the "Verein zur Wahrung der Interessen der Chemischen Industrie Deutschlands," the total consumption of ethyl alcohol for dye manufacture in Germany was, in 1897, 1,100,000 kilos. It is probable that it is now double this. It is stated that the Badische Anilin Soda Fabrik use from 90,000 to 100,000 kilos of ethyl chloride per annum in colour making, the price of production being given at 10d. to 1s. per kilo.

Consumption of alcohol in foreign colour works.

STATEMENT A PUT IN BY PROFESSOR A. G. GREEN.

Dye-stuffs and other Coal-tar Products into which Ethyl Alcohol enters as a Constituent.

Monoethylaniline, diethylaniline, ethylbenzylaniline, ethylorthotoluidine, ethylamidophenol, diethylamidophenol, ethoxybenzidine, diphenetidine, diethylamidobenzaldehyde, tetraethyldiamidobenzhydrol.

Brilliant Green, Patent Blue V, Acid Green, Ethyl Violet, Fast Acid Violet, Various Acid Violets, Night Blue, Thiocarmine, New Methylene Blue, Nile Blue 2B, Spirit Eosine, Pyronine B, Rhodamine B, and 6G, Quinoline Yellow Chrysophenine, Diamine Yellow N, Diamine Scarlet 3B, Thioflavine, Tartrazine, Auramine G, Benzopurpurine 10B, Indazurines, and a number of others.

Dye-stuffs and other Coal-Tar Products into which Methyl Alcohol enters as a Constituent.

Monomethylaniline, dimethylaniline, methylbenzylaniline, dimethylmetamidophenol, methoxybenzidine, dianisidine, dimethylamidobenzaldehyde, dimethylalphanaphthylamine, dimethylparaphenylene diamine, tetramethyldiamidobenzophenone, tetramethyldiamidodiphenylcarbinol, etc.

Malachite Green, Patent Blue, Light Green SF, Victoria Green, Victoria Blue, Methyl Violet, Crystal Violet, Fast Green, Acid Violets, Indophenol, Gallocyanine, Prune, Meldola's Blue, Gallanilic Violets, Muscarine, Gallamine, Blue, Basle Blue, Nile Blue A, Capri Blue, Methylene

Blue, Neutral Violet, Neutral Red, Neutral Blue, Azine Green, Indazine, Acridine Orange, Pyronine G, Auramine, Azo Violet, Benzoazurine, Heliotrope, Azoeosine, and others.

DYE-STUFFS IN THE MANUFACTURE OF WHICH PURE METHYL OR ETHYL ALCOHOL IS REQUIRED AS A SOLVENT.

Gallocyanine, Gallanilic Violets, Gallamine Blue, Muscarine, Rhodamine 6G, Eosine, Anisolines, and many others.

Alcohol is also used as a solvent in the extraction or crystallisation of many intermediate products for which the use of methylated spirit is very unsuitable. As important cases of this may be mentioned the following: Salicylic acid is used in large quantities by brewers and others as an antiseptic agent, also in the manufacture of various salicylates which are largely employed in medicine, and in addition it forms the raw product of a series of important dyestuffs such as Diamond Black, Alizarine Yellow, Chrysamine, and others. Tannic acid is used in medicine, as a mordant in dyeing and calico printing, and also forms a starting point for the manufacture of gallic and pyrogallic acids, the former of which enters into the constitution of a large number of important colouring matters (Gallocyanine, Gallamine Blue, etc.), whilst the latter has a very large sale as a photographic developer.

The alcohol employed as a solvent can be partly recovered, rectified, and used again for the same purpose. In most cases there will be a loss of from 5 to 10 per cent. on each operation.

Many colouring-matters such as Gallocyanine appear in more than one class since alcohol (methyl or ethyl) is used in their manufacture both as a constituent and a solvent.

With one or two exceptions the alcoholic colouring-matters are not manufactured at all in England, and in these cases only in small quantity and from imported raw material such as dimethylaniline, which already contains the alcoholic constituent. Amongst the causes of this, the necessity for pure cheap alcohol is a factor of considerable importance.

STATEMENT B AND TABLES PUT IN BY PROFESSOR A. G. GREEN.

ARTIFICIAL MEDICINAL AGENTS.

In addition to its bearing upon the colour industry, the necessity for pure alcohol has an equal importance in the manufacture of artificial therapeutic agents, a trade which commenced some twenty years ago, and has already attained large proportions in Germany. For the manufacture of most of these products, methyl or ethyl alcohol is required as a chemical constituent. As an instance of such compounds may be mentioned the important febrifuge and antineuralgic known as "anti-pyrine." It is stated that Messrs. Meister, Lucius & Brüning, of Hoechst, who are the patentees of this product, made at one time a profit on it alone of £60,000 a year. The patent has expired, and English manufacturers would probably take up its manufacture, were it not for the fact that the profitable production of the raw product—pure acetic ether from methylated spirit—is at present impossible in this country.

The annexed table gives a list of some medicinal agents in which alcohol (methyl or ethyl) is necessary :—

EMPLOYMENT OF METHYL AND ETHYL ALCOHOLS IN THE MANUFACTURE OF MEDICINAL AGENTS.

TABLE 1.—*Some Substances which have Ethyl or Methyl as a necessary Component.*

Commercial Name.	Chemical Name.	Formula.	Percentage of Combined Ethyl as Alcohol.	Percentage of Combined Methyl as Methyl Alcohol.
Acetal	Ethylidene-di-ethyl-ether	$CH_3—CH(OC_2H_5)_2$	78	
Ethyl chloride		C_2H_5Cl	71	
„ bromide		C_2H_5Br	42	
„ iodide		C_2H_5I	12	
„ formate		$HCOOC_2H_5$	62	
Holocaine	Para-diethoxyethenyldiphenyl-amidine-hydrochloride.	$(OC_2H_5C_6H_4NH.C.CH_3:N.C_6H_4OC_2H_5)HCl$	27	
Homoarecolin	Methyl-tetra-hydro-nicotinic acid	$C_7H_{10}.(C_2H_5)NO_2$	27	
Mercuryethylchloride		HgC_2H_5Cl	17	
Phenacetin	Para-oxyethylacetanilid	$C_6H_4<^{OC_2H_5}_{NH.CH_3CO}$	26	
Tetra ethyl ammonium hydroxide		$N(C_2H_5)_4OH$	12·5	
Tetronal	Diethylsulphonediethylmethane	$(C_2H_5)_2.C.(SO_2C_2H_5)_2$	96	
Anæsthesin	Ethylesterpara-aminobenzoic acid	$C_6H_4NH_2COO.C_2H_5$	28	
Subcutin	Anæsthesin-paraphenolsulphonate	$C_6H_4NH_2.COO.C_2H_5.HO.C_6H_4SO_3H$	13 5	
Codethyline		$C_{17}H_{17}O.N[OH][OC_2H_5]$	21 6	
Dionine	Ethyl-morphine-hydrochloride	$(HO.C_{17}H_{17}.NO.OC_2H_5).HCl$	13	
Valyl	Valeric acid diethyl-amide	$C_4H_9CO.N(C_2H_5)_2$	59	
Eupyrin	Para-phenetidine-vanillin-ethyl carbonate.	$C_6H_4(OC_2H_5).N.CH.C_6H_3(OCH_3)O$	18	
Malarin	Acetophenone-phenetidine citrate	$C_6H_4<^{OC_2H_5}_{N=C(CH_3)(C_6H_5)}$	18	25
Malakin	Salicyl-paraphenetidine	$C_6H_4(OC_2H_5)N:CH.C_6H_4(OH)$	19	
Sulphonal	Diethyl-sulphonedimethyl-methane	$(CH_3)_2C(SO_2.C_2H_5)_2$	40	28
Sulphaldehyde				
Saliphonin	Salicyl-para-phenetidine	$C_2H_4(OC_2H_5)NH.CO.C_6H_4(OH)$	20	
Thymacetin		$CH_3>C_6H_2<^{OC_2H_5}_{NH.(CH_3CO)}$ C_3H_7	22	15
Urethane	Ethyl-carbamate	$CO<^{NH_2}_{OC_2H_5}$	52	
Bromalin	Brom-ethyl-formine	$(CH_2)_6N_4(C_2H_5Br)$	22	
Euchinin	Quinine-ethyl-carbonic-ester	$(C_2H_5OCO.OC_{20}H_{23}N_2O)$	11·6	
Methyl chloride		CH_3Cl		63
„ bromide		CH_3Br		53·7
„ iodide		CH_3I		22·5
„ loretin	Para-methylmetaiodoortho-oxy-quinoline-ana-sulphonic acid.	$CH_3I.OHC_9H_3N.SO_3H.H_2O$		8
„ urethane	Urethylan	$CO(NH_2)(OCH_3)$		42 5
Methacetin	Para-oxy-methyl-acetanilide	$C_6H_4OCH_3.NH.CH_3CO$		20·6
Methonal	Dimethylsulphonedimethyl methane	$(CH_3)_2C.(SO_2CH_3)_2$		64
Methylal	Methylene-dimethyl-ether	$CH_2.O(CH_3)_2$		50

Prof. A. G. Green.

16 Nov. 1904.

TABLE 2.—*Some Substances in which Alcohol is a necessary Factor, though being decomposed.*

Commercial Name.	Chemical Name.	Formula.	Percentage Ethyl Alcohol.	Percentage Methyl Alcohol
Chloroform (where not made from acetone.)	-	$CHCl_3$	37·4	
Iodoform (where not made from acetone.)	-	CHI_3	12·7	
Bromoform (where not made from acetone.)	-	$CHBr_3$	49·5	
Chloral orthoform	Chloral-amino-hydroxy-benzoic-methyl-ester.	$C_6H_3(COOCH_3).OH.N.CH.CCl_3$	15·5	10·8
Nirvanin	Diethyl-glycocoll-para-amino-hydroxy-benzoic-methyl-ester.	$HCl.(C_2H_5)_2.N.CH_2.CO.NH.C_6H_4(OH)COOCH_3$	29	10
Eugenol acetamide	-	$CH_3.C_2H_5(OCH_3)OCH_2CONH_2$	20·8	
Methenyl para-phenetidine		$C_2H_5OC_6H_4NH.CH.N.C_6H_4OC_2H_5$	32·5	
Chloral ammonia	-	$CCl_3CH(OH)NH_2$	28	
Chloralamide	-	$CCl_3.CH(OH)NH.CHO$	24	16·6
Chloral acetophenone oxime	-	$C_6H_5C.(CH_3)NO.CHOH.CCl_3$	15·7	
Iodoformol	-	-		
Forman	Chloro-methyl-menthyl-ether	$C_{10}H_{19}O.CH_2Cl$	–	16
Thymyloform	-	$[C_6H_3.(CH_3).(C_3H_7)O]CH_2$	–	20
Polyformin	Diresorcin-hexamethylen-tetramine	$(C_6H_4(OH)_2)_2.-(CH_2)_6N_4$	–	53
Galloformin	Hexamethylene-tetramine-gallic-acid	$C_6H_2.(OH.)_3COOH.(CH_2)_6N_4$	–	53
Mercuric formamide	-	$(HCO.NH)_2Hg$	–	13
Guiaform	Methylene-diguaiacol	$CH_2[C_6H_3(OH)OCH_3.]_2$	–	12
Guaiethol	Mono-ethyl-ether of pyrocatechol	$C_6H_4<^{OC_2H_5(1)}_{OH(2)}$	33	
Tannoform	Methylene-ditannin	$CH_2(C_{16}H_9O_9)_2$	13	
Tannocasium	-	-		
Cetarin	Anhydro-methylene-citrate of sodium	$(NaOCO.CH_2)_2CO<^{CH_2}_{CO}>O$	13	

Mr. JAMES WIGGLESWORTH, called; and Examined.

Mr. J. Wigglesworth

16 Nov. 1904.

547. (*Chairman.*) I think you represent the firm of Hodgson & Simpson, of the Calder Soap Works, Wakefield?—Yes.

548. Are you a member of the firm?—I am a partner in the firm.

549. When was the firm established?—In 1818.

550. Has it been carrying on business since that date? Yes, ever since then.

551. What number of workpeople do you employ?—We have now about 400 workpeople.

552. Do you manufacture soaps of all kinds?—All descriptions.

553. How would you classify them—as we do in the Trade Returns?—We have household and toilet soap, and soap for manufacturing purposes—that is soap used for the woollen mills and other manufacturing purposes.

Soap Industry: Use of spirit not essential except for making finest quality of transparent soap.

554. To what extent does spirit enter into the manufacture of soap; is it absolutely necessary?—It is not absolutely necessary to use spirit in soap, but toilet soap which is prepared with spirit is very much more appreciated than that which is not prepared in that way.

555. It is necessary, is it not, for making transparent soap?—No, it is not necessary for transparent soap. Transparent soap could be made very easily without spirit, but the resulting soap is very inferior, and being made by the cold process retains a very considerable excess of alkali. It is, therefore, very deleterious, and it is a great shame that such soap should be allowed to be put on the market and sold as toilet soap. It is really the very worst soap that it is possible to use for the human skin. Ignorant people who buy this cold process transparent soap may do a lot of harm to children, especially if they have delicate skins.

556. At the time when the 3d. duty was placed upon imported transparent soap, was it not held that spirit was absolutely necessary?—Spirit is necessary to make the finest quality of transparent soap. The transparent soap can be made without spirit if it is made by the cold process. The cold process is a German invention, and by means of it the soap can be made at a third of the price, and will be better looking than the finer qualities of transparent soap. I have some samples here of the soap that we make.

557. As a matter of fact, I suppose the proportion of transparent soap that is made is small?—Yes, it is small.

Spirit could be usefully employed in making opaque soaps.

558. It is not really very popular now, is it?—No; but on the other hand spirit has a very useful effect in other soaps, because it aids saponification.

559. If it can be usefully employed in soaps that are not transparent, in what way exactly would you employ it? Do you, as a matter of fact, employ it now?—We employ spirit in nothing else than transparent soap.

560. But you would be glad, if you could, to employ it on your opaque soaps, I presume?—If we had permission we should be glad to do it; we would find it useful.

561. What quantity would you want—a large quantity?—At the present time I cannot say what quantity we should want. It is not very necessary to use it. The great thing is that we want to use it for the best transparent soaps.

562. It is mainly in connection with the transparent soap that you would like to use it?—Yes. We are using methylated spirit at the present time under bond and under the supervision of the Excise authorities.

563. Taking your other soaps, and supposing you were free to use pure spirit, would you use it to any very large extent, or would you use it at all?—We might use it. It has the effect of preventing soap cracking, which is a consideration.

564. Clearly it cannot be regarded as essential?—It is not essential to other soaps than transparent soaps.

565. Taking your works at the present time, could you give us some idea what amount of methylated spirit you are using per annum?—We have permission to use 20,000 gallons a year.

566. Do you work up to that total?—We work to more, and I am informed that we get an extra quantity by applying for it. We are under bond, I may say, at the present time to use this in a proper manner.

Use of methylated spirit necessitates the employment of strong and expensive perfumes.

567. Do you recover the spirit and use it over again?—We recover part of it.

568. What proportion do you suppose you recover?—I should say rather less than half.

569. And then how do you treat the recovered spirit?—It is used in place of the spirit that has not been recovered.

570. I suppose it is largely purified by the time it is recovered, is it not ?—I believe the recovered spirit does not contain the amount of methyl spirit that it did in the first instance; it is purer than the original methylated spirit.

571. Do you mix it with your store of methylated spirit, or do you use it just as it is ?—I cannot say positively; it may be done either way.

572. As I understand, the objectionable smell remains in the product and has to be covered by the stronger perfumes ?—Yes.

573. And that adds to the cost of production by increasing your expenditure upon perfumes ?—It adds very much indeed to it.

Price of methylated spirit not a serious consideration

574. What price do you pay for your methylated spirit ? It varies in price. Of course it is the market price that we pay.

575. Do you find the price at all burdensome ?—No.

Excise supervision if duty-free pure spirit were used.

576. You suggest in your *précis*, that in order to render the spirit unpotable, it might be incorporated with a certain percentage of soap. In your works, would the spirit be much in the hands of separate workmen ?—I may tell you that, at the present time, we are using it in an isolated building entirely separated from the rest of the works. The excise authorities have a latch key, and they can come into this building at any time, day or night, and inspect.

577. Is that the building in which the manufacture o transparent soap is wholly conducted ?—Yes. I may tell you that in the manufacture of transparent soap, the soap is made in the ordinary way first, then it is shredded and the natural water of it is dried out, then the soap is dissolved in methylated spirit and part of the methylated spirit is distilled off. The resultant soap and spirit is then cast into blocks and cut up. It has to be kept for a long time to enable the spirit to come away at normal temperatures.

578. Supposing you were using pure spirit instead of methylated spirit, should you be apprehensive of your workmen either drinking it at the works, or trying to carry it away from the works for the purpose of drinking it elsewhere; and should you feel it necessary to keep a very careful watch on them ?—My idea is to put some poisonous stuff into it. I have here a specimen of transparent soap which was made at the end of last week (*handing in same*).

579. Is that finished ?—Yes, it is finished, but it will have to be kept for months. Eventually that piece of soap will be like this (*producing a tablet ready for sale*). As the soap is kept, it gets more and more transparent. The second tablet I produce may be about three months old, and it will have a better appearance if it is kept for a year.

580. (*Mr. Tyrer.*) At ordinary temperature, do you mean ?—Yes.

581. (*Mr. Nicholson.*) Has this soap been made with methylated spirit ?—Yes.

582. (*Chairman.*) This second specimen is not very transparent, is it ?—I think the cloudiness yon notice is due to the refracted light of the engraved letters.

583. (*Mr. Tyrer.*) It is more transparent than the tablet made at the end of last week ?—Yes, it is.

584. (*Sir William Crookes.*) As the alcohol goes off the soap becomes more transparent ?—Yes.

585. (*Mr. Scott-Montagu.*) I suppose that is the way Pears' soap is made ?—Yes. Of course Pears are the big people in this business.

586. (*Chairman.*) Do you think it would be necessary to keep a considerable watch and ward over the workmen ?—I should think that if the workpeople get to know that this spirit is fit to drink, we should have to keep a considerable watch over them.

587. Because, possibly, they would have opportunities of getting it away before it had been mixed with the soap ?—I should say there would be no difficulty in mixing it with the soap; but still, if it were coming away from the soap, a watch would have to be kept.

588. For the recovered spirit you mean ?—Yes.

Mr. J. Wigglesworth

16 Nov. 1904.

589. In your *précis* you make a suggestion which is rather of a murderous kind, namely, the introduction of poison; you would not propose to introduce poison and then to tell your workmen that they drank it at their own peril, would you ?—I was in a corner when I made that suggestion. I did not know of any other thing.

590. (*Sir William Crookes.*) If you introduced arsenic, that would remain in the finished soap of course ?—Yes, but I do not think it would be deleterious in the soap itself.

591. Would it not, when it was being used for washing young children ?—No, I think the small quantity that would be there would not.

592. (*Dr. Thorpe.*) You could not make pills of such a soap as that ?—No. Curd soap is used for making pills, according to the British Pharmacopœia. I think they do not use transparent soap for that purpose.

Export trade to Colonies checked by protective tariffs rather than by competition of German, etc., soaps.

593. (*Chairman.*) You say that in the colonial markets, you have found the German and the French soaps have a better finish and a finer scent than the English soaps; have you a large export business ?—We have an export business to some of the colonies; but in most of them we are barred out.

594. By the duties ?—Yes; and because the colonial people can nearly supply themselves. It is a trade that we shall lose, perhaps.

595. What proportion do you export of your total trade ?—About 10 per cent.

596. Not more than that ?—Not more than that.

597. The rest is all sold in the home market ?—Ninety per cent. I should say, is sold in the home market.

598. (*Mr. Tyrer.*) But even there the appearance of the foreign soap is better, as I understand ?—The appearance of this cheap German soap made by the cold process, is better. It is abominable stuff. We make it as well, but it is not fit to wash pigs with. It has a much better appearance than the soap I have produced here to-day. I could make you some in this room this afternoon that will be fit to sell the day after to-morrow, and would be better in appearance and better finished than the soap I have produced, which has been made with a great deal of extra expense. The German soap could be made at a third of the price of the other.

599. (*Chairman.*) Is there much of that German soap in the colonial markets ?—Yes. A very large quantity of Austrian.

600. Would you say that you lose your trade in the colonial markets because of the colonial tariffs, or because of competition of the German and French soaps ?—It is not the foreign competition which is the cause of it; they are making their own soaps now.

601. Therefore, I suppose, the duties in the colonies are pretty high on your soap ?—Nearly all the colonies have a duty on our soap. In the West Indies, the duty is small, but with Sydney and New South Wales our trade has gone to nothing on account of the duty.—It was pretty fairly Free Trade there until about eight or nine years ago.

602. Was it Federation which closed the ports of New South Wales ?—We are doing very little there now.

No concerted action taken for removal of Revenue restrictions.

603. Then you say in your *précis* that no united action has been taken with a view to overcoming your difficulties about the use of spirit, but that you have brought the matter before the authorities on several occasions; is that of late ?—I came to this building once about eight or nine years ago; I do not know where I got to, but I took the gentleman's name where I finally landed. He said—I remember it quite distinctly—"Well, you know, we get an enormous revenue from this spirit, and we must protect it to the fullest extent."

604. That is a commonplace; but what did you propose to him ?—I think I wanted to bring the question before the authorities.

Price of Methylated Spirit, not a serious matter. (*See* also Q. 574–5.)

605. Did you make any definite proposal ?—Not at that time.

606. What moved you; was it the unsuitableness of the methylated spirit ?—Yes, just as I have stated to-day.

607. It was not the price ?—No, it was not.

Mr. J. Wigglesworth

16 Nov. 1904.

608. In fact, you do not complain of the price of the spirit now?—Not at all.

609. That does not embarrass you?—No, the price is nothing. It is the 11s. 5d. duty per proof gallon: that is the thing we object to, as it is prohibitive.

610. (*Mr. Nicholson.*) Or rather the 11s. duty?—I was not aware that it is 11s. now.

611. (*Mr. Tyrer.*) As a matter of fact you use methylated spirit, and therefore it does not affect you?—But we do not get the results we ought to get and should get if we used other spirit.

Use of duty-free pure spirit—Its real advantage over methylated spirit would be the saving of quantity and cost of perfumes.

612. Can you give us some sort of off-hand comparison, taking the samples of soap before us, between those you make with the methylated spirit that you use and those made with spirit not methylated; what would be the difference—would the latter be doubly transparent?—I believe the soap made with methylated spirit is quite as transparent as that made with pure spirit. I may say we have made small quantities of soap with duty paid spirit, but there is no appreciable difference in the transparency.

613. The real point would be that you would be able to use the finer kinds of scent rather than the others?—Yes.

614. That is where your advantage comes in?—Yes; it would enable us to use the finer kinds of scent, and even if we continued to use the scent we are using now, I dare say we could then get better results with a third of the quantity. Scent is very expensive.

615. What is the proportion of scent when diluted with the article? I will put in this way: What amount of spirit to which a sufficient quantity of strong scent has been added is required in proportion to the bulk?—I should say perhaps one-thirtieth.

616. Which would be about 3⅓ per cent. of the solution to the scent itself?—Yes.

617. The solution of the scent would be about, how strong?—Some scents are solid. A lot of the synthetic scents we use now are crystals. They are made abroad.

618. (*Chairman.*) Then you do use these synthetic perfumes?—Some of them. Then we get the musk pods; those I think are the actual testicles of the musk animals. We dissolve them in this methylated spirit. It is no use using pure spirit to take out the essential matter, and then to put methylated spirit in for transparent purposes.

619. (*Mr. Tyrer.*) We have got at this point: that the methylated spirit produces quite as good a product as the pure spirit, but the pure spirit is used when it is preferable for the purpose of making the scenting materials. What proportion of the spirit may be taken to be in the scenting materials—10 per cent.?—Not so much as that. The soap has dissolved in it in the first instance a very large quantity of the spirit, and perhaps half that is distilled off; so that at least about half of the total quantity is used over and over again.

620. (*Mr. Scott-Montagu.*) Do you consider that your foreign competitors have a distinct advantage, because they can use pure alcohol under fair conditions?—In neutral markets, yes.

621. Then do you consider that some modifications of the restrictions upon the use of alcohol are desirable in your trade?—Yes. If I might make a suggestion, I would suggest that the bonds be increased to any extent within reason.

622. Methylated spirit, though you use it to a great extent, is not so suitable for your manufactures as pure alcohol would be?—It is not so good. There is no real difference, except that of the objectionable smell in the resulting article.

623. Is that your chief objection?—That is the only objection we have.

Quantity of alcohol in finished soap is small, and practically not recoverable.

624. (*Chairman.*) Can it be said that any of the alcohol is present in the soap as delivered to the consumer?—Yes, there is some in those tablets that I have produced. You can smell it.

625. Could the alcohol be recovered from these tablets?—There is only a very small quantity of alcohol in them. It has nearly all evaporated. The greater the evaporation the greater the transparency of the soap.

626. (*Mr. Scott-Montagu.*) Would you say it is practically irrecoverable?—I should think it is irrecoverable. You can tell that the soap has been prepared with alcohol, I have no doubt.

Customs duty on transparent soap. Its removal not a serious matter to the home manufacturer, if he could use duty-free pure spirit. (*Vide* Qs. 674 to 678).

627. (*Chairman.*) If we were to allow you to make this soap with duty-free alcohol, not methylated, then, strictly speaking, we ought to remove that duty of 3d per pound which is at present charged upon transparent soap from abroad. Would that not be rather a serious thing for your home trade; should you not be afraid of foreign competition if that duty of 3d. per pound was removed?—I think we ought not to remain in business at all if we cannot retain our own market against any foreign competition.

628. I am delighted to hear you say so, but still at the present moment the home market is protected for you by a duty of 3d. per pound, which is a rather material factor, seeing that that duty was put on upon the supposition that it was pure duty-paid spirit which was used in the making of the soap; but now you have discontinued the use of duty-paid soap, and are using methylated spirit, which has enormously diminished your cost of production?—Yes.

629. If the soap from abroad came in at 3d. per pound less than it does now, how would that affect you, do you suppose? 3d. per pound seems to be a large amount?—We have our materials and everything at the lowest price, and we are competent to make soap with the whole world. I should not fear any foreign competition, even if this 3d. per pound were taken off, unless the foreigner came over here and spent, say, an enormous lot of money in advertising. Then he might get a certain amount of business. Fair competition we should not fear at all.

630. What is the wholesale price per pound of soap of the quality you have shown us to-day?—The wholesale price of that soap is about 2½d. each tablet. That is the very lowest wholesale price.

631. How many tablets go to a pound, do you suppose?—About five.

632. So that this soap is about a shilling per pound, roughly?—Yes.

633. Therefore 3d. per pound is a heavy duty?—Yes, it is a prohibitory duty.

634. (*Mr. Scott-Montagu.*) So you have got protection?—Yes, it is protection.

635. (*Chairman.*) And you are quite prepared to do without it?—Yes.

636. (*Mr. Scott-Montagu.*) Would you rather have pure alcohol and do without protection?—I am sure we would.

Deleterious effects of cheap transparent soaps.

637. (*Sir William Crookes.*) The cheap and common variety of transparent soaps has a very deleterious effect upon the skin, has it not?—Extremely so. It is the worst soap there is in the world.

638. From what I have noticed, all transparent soap is objected to by some people on that account?—Yes, I think it is so.

639. People will not have some of the best transparent soap ever made by well-known makers, because they say all transparent soap attacks the skin?—That is so.

640. Therefore that is another objection?—And a very great objection. There is a very large amount of sugar put into this common transparent soap. We had to call the attention of the Customs authorities to the introduction of some American transparent soap, because of the sugar in it, there being now a duty on sugar.

641. It is not the sugar that affects the skin, but the alkali?—It is the excess of alkali in soap made, as that soap has to be made, by what is called the cold process. You get a certain amount of fatty matter and a certain amount of the very strongest alkali, and these are mixed—not boiled—at a low temperature, and combination takes place at that low temperature. Unless there is an excess of alkali in that soap, it will not become transparent. It is a most abominable thing that people should be allowed to sell such stuff for human use.

642. (*Mr. Tyrer.*) The soap prepared in that way gives a bad name to good transparent soap?—Yes.

643. (*Sir William Crookes.*) I know many cases in which transparent soap will not be used in the household, because they think it always affects the skin to such a great extent ?—I am afraid if we were to get duty-free alcohol, it would not prevent people making this bad soap.

644. If that bad soap were kept, would not the alkali effloresce out ?—No.

645. On keeping it for twelve months would it be still good in appearance ?—Yes, it would be very good in appearance.

646. (*Sir W. H. Holland.*) You regard the pure spirit in the light of a raw material I take it, or you would wish to use it as one of your raw materials ?—Yes.

647. And like all other manufacturers, you would wish to have your raw material on as favourable terms as possible ?—Decidedly.

Probable increase of business with use of duty-free pure spirit.

648. (*Mr. Nicholson.*) Can you give the Committee any idea of the quantity of alcohol which you would use in a year, if you were allowed to use duty-free alcohol ?—I should say that our trade for this soap would increase to such an extent, that we might look forward to a very large increase. I am not quite sure whether we use 30,000 gallons a year now.

649. You are talking of methylated spirit now. I understand ?—Yes.

650. Does that answer all your purposes, except for transparent soap ?—It answers all purposes, except for the abominable smell it leaves behind.

651. And you would anticipate a large increase of trade if you were enabled to use the pure spirit ?—Yes, I should expect a very large increase.

652. In the trade in that particular quality of soap ?—Yes.

Use of alcohol in making soap—its object and method of employment.

653. (*Dr. Thorpe.*) You have told the Committee that the real object of using alcohol is to eliminate the excess of the alkali and the other uncombined materials from the true soap-forming substance; that is the object of using the alcohol, is it not ?—I take it that the principal object in using alcohol in the finishing of this soap, is to bring about a closer chemical combination between the alkali and the grease.

654. What, in effect, you say is this—you get a kind of soap which you prepare yourselves ?—We get a perfectly pure soap to begin with. That soap is opaque.

655. Then you shred it and dry it and get rid of as much water from it as you can, by exposure to the air, and then you dissolve it in the alcohol ?—Yes.

656. Does some portion of the shreded soap dissolve, and some portion not ?—All the shredded soap dissolves.

657. Then you take that solution of soap and methylated spirit, and you recover a certain quantity of the alcohol in it by distillation ?—Yes.

658. You have told us that rather less than half comes away in the still ?—I have not the figures by me, but I should say about half is distilled away in the form of alcohol.

659. Then you have left in the still a very concentrated alcoholic solution of this soap ?—Yes.

660. That you run into moulds, and it solidifies ?—Yes.

661. Then the blocks are cut up, and the individual pieces are exposed freely to the air, so that the rest of the alcohol, which is contained in the substance, gradually evaporates, and as it evaporates the soap becomes transparent ?—That is so.

Purification of methylated spirit recovered in course of manufacture.

662. This recovered alcohol that you get is not quite the same methylated spirit that you put in, is it ?—I think it is purer. It leaves a larger amount of the methyl alcohol, the denaturing agent, in the soap.

663. You have not had analyses made, I suppose, of the recovered methylated spirit, have you ?—The Excise people do that. The Exciseman takes our samples occasionally. I think they have always found out that there is a smaller amount of methyl in it.

664. You may take it from me that what disappears from the recovered methylated spirit is not the methyl alcohol, but the substances which impart a nauseous flavour, both of taste and of smell, to the spirit ?—I think the nauseous stuff is left in the soap.

665. The recovered spirit, is, therefore more free from the nauseous materials ?—Yes.

Mr. J. Wigglesworth

16 Nov. 1904.

666. Since you recover spirit, and since you incidentally, by manipulating it with the fatty matter of the soap, get rid of the substances which make the alcohol have an objectionable smell, why cannot you use that recovered spirit with those delicately scented scents that you want, and so use it again for the manufacture of the soap ? You would be in the same position then, I may point out, as if you had used pure alcohol ?—No.

667. Why not ?—I think the objectionableness of the recovered alcohol is only slightly removed. I think there is very little difference between the recovered alcohol and the alcohol that is put in, in the first instance.

668. As you tell us, our officers send us samples, and, therefore, we are in a position to know how far the objectionable material has been removed ?—Yes, you would know.

669. We do know. You may take it from me that, practically, sometimes the objectionable material is so far removed that there is very little difference between it and pure alcohol ?—You have the facts. I shall have to submit to your facts if that is so.

670. Therefore I venture to say that you could use that recovered alcohol exactly as you could perfectly pure alcohol so far as regards scents ?—But still the soap as manipulated in the first instance would contain all this objectionable matter.

671. Perfectly true ?—We should have to get rid of that.

672. You would have to get rid of that, and that would make an inferior quality of scented soap ?—We should have to make two qualities. So far as my nose teaches me, the recovered alcohol has a very objectionable smell—almost as objectionable as the smell at first; but you say you have had this analysed, and I must accept your facts. I understood that there was an objection to our distilling over this alcohol, because it was better than the other.

673. I listened very attentively to your answer to the Chairman as to what you did with the recovered alcohol; you gave the Committee to understand that sometimes you mixed the recovered alcohol with fresh methylated spirit, and sometimes you did not ?—I should think it is nearly always put into the still along with fresh alcohol; it is not isolated.

Customs duty on transparent soap. (*See also* Qs. 627-636.)

674. (*Mr. Tyrer.*) Dr. Thorpe's question must be taken in conjunction with your statement that you are perfectly satisfied with the price of methylated spirit. Following upon that you were reminded of the existence of the Customs duty of 3d. on imported soap which had been produced abroad, and you were brave enough to say that you would not mind its abolition, because for the moment you could compete. Suppose that duty were taken off and the imported transparent soap came in made with pure German spirit cheaper than the methylated spirit as we have it, what would be your position then ? You would probably be asking to have that 3d. put back ?—If we could use pure spirit instead of methyl, we should have no difficulty in competing with anybody in the world so far as the resulting soap was concerned.

675. With pure spirit at a less price than methylated spirit as it is now ?—Yes.

676. It is an important question ?—Pure spirit, I take it, is on the Continent rather cheaper than the methylated spirit is here now.

677. It is considerably cheaper ? Should we not get the pure spirit at the price that it is on the Continent ?—We should, I suppose.

678. (*Chairman.*) It would be cheaper than the methylated spirit, but whether it would be as cheap as the pure spirit on the Continent is another question ?—I think the increase of business would more than compensate for any possible danger there might be from the foreigners. There is very little soap imported into this country, although I may say that lately the Americans dumped some down from Chicago made from by-products.

679. (*Dr. Thorpe.*) Are you aware that in France duty-free spirit is not allowed in the manufacture of this soap ?—I am not aware of it.

Mr. HARRY ENTWISTLE called; and Examined.

Mr. H. Entwistle.

16 Nov. 1904.

680. (*Chairman.*) You represent the Association of Manchester Process and Wood Engravers, I believe?—Yes.

681. Is that an association the members of which are confined to Manchester?—No. We take in an imaginary line drawn from Liverpool through Birmingham to the East Coast; it is practically the North of England.

682. Has it a large membership?—No, it has not a large membership at present. It is a newly-formed association, and it has not been going very long. I could not tell you the exact number.

683. I suppose the interest of the Association in the particular question before the Committee results from the application of photography to engraving?—Yes, in the wet plate process.

Alcohol in photography.

684. Then, in fact, what you are interested in is photographic materials?—Yes.

(1) For making collodion.

685. May I take it that really the whole of your interest centres in photographic materials?—That is so.

686. What are the principal materials of that kind into which spirit enters?—Collodion.

687. Would that be far the most important?—Yes, far the most.

688. Are there any others?—There is the use of spirit for drying dry plate negatives rapidly in the case of press work or anything of that kind, and the use of spirit for stripping collodion.

689. The quantity of collodion that is used in connection with photography, I suppose, is very large?—Yes, we are using it all the day long.

690. Where do you procure the collodion that you use?—We generally get it from Mawson & Swan, Newcastle.

691. Is it manufactured there?—Yes.

692. Is it manufactured from pure spirit?—We understand so.

693. Is the price very high?—Yes, it is. It runs about 18s. 10d. per Winchester quart. It is half alcohol and half ether.

694. Do you never buy imported collodion?—I have not done so personally.

695. There is very little imported, a matter of fact. You are interested in the use of spirit for the manufacture of collodion; could you manufacture it yourself?—Yes, we might if the spirit was cheap enough.

696. But as a rule you buy it?—As a rule we buy it.

(2) For stripping and drying negatives.

697. Then in the process of photography you would use the spirit for the purpose of stripping your negatives, I understand?—Yes, and for the purpose of drying dry plate negatives.

698. Would it be a large quantity that you would use?—In some processes, yes; it would where they use the dry plate process.

699. It would be a large quantity?—Yes, because they must get the negatives dried quickly.

Methylated spirit (mineralized) used but said to be unsuitable.

700. Is methylated spirit not suitable?—It is not suitable.

701. But it is used, I understand?—It is used, and we often have spoilt negatives with it.

702. Can you give the reason why it should not be suitable?—I think the naptha is precipitated by the water in the film, and so we get a white opalescence.

Reduction in price of collodion if made with duty-free spirit.

703. The price of collodion would be very much diminished if it could be made with duty-free spirit, would it not?—Yes, certainly. As a matter of fact we are paying, I think, 4s. 4d. per pound for absolute alcohol and 3s. per gallon for methylated spirit, which I think works out somewhere about 3d. per pound. It would practically be that difference in the cost.

704. Surely that is very high, is it not?—That is what we are paying at present.

705. Are you using it in large quantities?—We do not buy much more than a gallon at a time, as the insurance company will not allow us to stock more on the premises. We send from time to time to the dealers, as we require it.

706. (*Dr. Thorpe.*) Do you get it from the small dealers?—Yes.

707. You use, therefore, the ordinary methylated spirit?—Yes.

708. Which is mineralized?—Yes.

709. Which therefore gives the opalescence of which you complain?—Yes.

710. There is no reason why you should use mineralised spirit, is there?—Rectified alcohol has too much water in it.

711. You can use unmineralised methylated spirit?—We cannot get that.

712. They do not stock it?—No.

713. Can you not find some people who do?—I have tried all over Manchester.

714. We have an officer in the district, and if you applied to him, he would help you to get every facility for obtaining it?—We should have to buy five gallons at a time then.

715. Is that an insuperable objection?—Our insurance company object to our keeping more than a gallon at a time on the premises.

716. (*Mr. Tyrer.*) Even in a separate building?—We are not in a separate building. As a matter of fact, they have made us provide a safe to keep the collodion in.

717. In which you can keep the spirits at the same time?—Yes, but we are limited to the quantity in the safe even.

Ordinary (unmineralized) Methylated Spirit suitable for drying negatives.

718. (*Chairman.*) Do I understand that if it were not for that difficulty, and if you could use ordinary methylated spirit—that is to say, non-mineralised methylated spirit—that would satisfy you?—Only for drying negatives; it is not suitable for collodion.

719. So far as the use of spirits in the processes of photography is concerned, as apart from the preparation of photographic materials, it would be quite satisfactory?—Yes, that would be quite satisfactory.

720. (*Mr. Tyrer.*) And you can get it?—We can get it in five gallon quantities—that is, if our insurance people would allow us to keep so much.

721. I think I know of cases that I could quote that would help you in the matter, in which they have given way?—My case may be rather different than that of others. I am in a warehouse, and, of course, the warehouse risks are very much greater than the risks in offices and other buildings of that sort.

722. (*Chairman.*) Do you occupy large premises?—We occupy a room about 60 feet by 40 feet at present

723. One room?—Yes.

724. Would it not be possible to make arrangements for storing your methylated spirits somewhere else in the neighbourhood?—Possibly it would. We have never tried that. Of course our main point is the use of alcohol for collodion; that is where it affects us most.

725. You say at the end of your *précis* that "The spirit being the employer's property, he would naturally take precautions to see that it was used for his profit and not wasted by the workmen"?—Certainly.

726. That would not be necessary if you use the ordinary methylated spirit, because that is quite sufficiently protected, is it not?—Yes; it is only in the case of absolute alcohol where that consideration would come in.

727. The process of making collodion surely could not be carried on in the ordinary premises of a photographer, could it?—Yes, I have made it myself.

728. (*Dr. Thorpe.*) Would not the insurance people object much more strongly to your having gun-cotton or pyroxiline in the place together with ether and things of that kind, than they do to the storage of five gallons of methylated spirit?—We have to store the ether and also gun cotton in the collodion we are already using; and I do not see that there would be any further danger in merely mixing them.

729. The insurance people do not object to that?—They have never objected to it in my case.

730. (*Sir William Crookes.*) How much stuff do you use?—In the case of my firm, we are not a very big firm, we are only a young firm as a matter of fact.

731. You speak of using a gallon, so I suppose you do not use at any one time more than that quantity of alcohol or ether ?—Not in my own firm.

732. (*Chairman.*) Is it your desire to have pure spirit mainly in order to improve the character of the materials that you use or the processes, or is it in order to cheapen the cost ?—We cannot use methylated spirit at all in making collodion because we get fog, owing to the impurities in the methyl alcohol.

733. (*Mr. Tyrer.*) May I ask whether, if you made your own collodion, you would use the methylated spirit which you have been hitherto using ?—No, we should not use methylated spirit for collodion at all; we could not.

Collodion; made with methylated spirit and methylated ether.

734. (*Dr. Thorpe.*) Are you not aware that large quantities of photographic collodion are made with methylated spirit ?—Yes, I am quite aware of that.

735. And good collodion too ?—It is not good keeping collodion.

736. I have used such collodion frequently. What happens to it ?—You get organic impurities in the silver-bath.

737. What do you mean by "organic impurities in the silver-bath"; what are they ?—So far as I understand, in methyl alcohol there are oily impurities from the crude wood spirit. I take it that it is crude wood spirit in the methylated alcohol.

738. There is no oily matter in it ?—Not from the tarry distillate of the wood ?

739. No, there is nothing oily in it at all—not what we chemists would call oily ?—There is acetone, is there not ?

740. There is ?—And acetic acid ?

741. There is no acetic acid ?—Would it not form silver acetate ?

742. No ?—Of course, I am not a chemist; I am only a photographer.

Q. 693.

743. (*Chairman.*) You gave us the price of collodion made from duty-paid spirit at 18s. 10d. per Winchester quart, which is half a gallon. Supposing you were to accept for your purposes collodion made from methylated spirit, what would you have to pay ?—I could not tell you; I have not worked it out. The only thing I can give you is the difference in price between absolute alcohol and methylated spirit.

744. You would save on your materials a very considerable amount ?—Certainly.

745. (*Dr. Thorpe.*) This collodion that you purchase is, of course, half of it ether ?—Yes, it is.

746. Do you know as a matter of fact that that ether is all methylated ether ?—I am told it is.

747. Therefore that is accountable for half; you do not know that the rest of it is made from methylated spirit ?—No, I do not.

748. (*Chairman.*) Do you, when you are buying it, contract for a collodion that is made from pure spirit ?—No, we simply order Mawson's collodion; we do not stipulate anything.

Mr. H. Entwistle.

16 Nov. 1904.

749. (*Sir William Crookes.*) How long have you been using Mawson's collodion ? How long do you know it from experience ?—I have found the collodion to keep good for a month or six weeks and we have no occasion to keep it for a longer time.

750. I was in the habit of using a good deal of collodion in former days in photography, and I found that methylated spirit was not quite so good as ordinary spirit, but I think that depended on the impurities in the spirit which do not exist now in good methylated spirit ?—Of course we have a lot of trouble with our silver-bath, and if we could get rid of all that we should be very pleased.

751. (*Dr. Thorpe.*) You do not by any chance get "finish" for methylated spirit, do you ?—I do not; I know the difference between a methylated finish and any other.

752. Apparently you seem to put up with a mineralised naphtha in the stuff, and apparently you are incapable of helping yourself ?—Of course, I am not incapable of helping myself. It is due to the action of the insurance company in my own case. I am only speaking of my own firm personally. I have had a lot of trouble with the insurance company through collodion.

753. (*Chairman.*) That is an accident of your position ?—In that case; but that does not get away from the fact.

754. It does not apply to the trade as a whole ?—No.

Apart from making collodion, there is nothing in the character of (ordinary) methylated spirit which makes it unsuitable for photographic processes.

755. Therefore the trade as a whole have nothing to complain of really as regards the spirits that they use in the processes of photography, as apart from the collodion ?—No, only the difficulty of getting hold of it. In Manchester I have tried myself and cannot get it.

756. (*Mr. Tyrer.*) Have you tried collodions other than collodions from the eminent firm you have referred to ?—No, I have not—only what I have made myself. If we could get the alcohol free, there is no doubt about it we could make up our own collodion and be quite sure of it, could we not ?

757. (*Chairman.*) You would want the ether as well ?—Yes, we should want the ether as well.

758. (*Dr. Thorpe.*) Would you have any objection in that case to using methylated ether ?—I should buy the pure ether if I was making up my own collodion—in fact I did so—and pure alcohol.

759. Still you have no objection to find with Messrs. Mawson & Swan's collodion which may be made with methylated ether ?—No, I have not found that go wrong.

760. (*Mr. Tyrer.*) You have stated it with considerable firmness, but do you feel quite sure that this fogging of plates is due to the collodion being prepared with methylated spirits ? As you say, it has not happened in the case of Mawson & Swan's collodion, and it seems probable, therefore, from your own admission, that it is due to the fact that you have used mineralised naphtha ?—I can only quote Sir William Abney's book on that—he gives that in his book, which is a standard text-book on photography.

761. You do not know whether unmineralised methylated spirit is used by your competitors in the trade, say in the South ?—I do not.

THIRD DAY.

Tuesday, 22nd November, 1904.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair*).

The Hon. J. SCOTT-MONTAGU, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. W. SOMERVILLE.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*).

Dr. ALFRED RÉE, called; and Examined.

Dr. A. Rée. 22 Nov. 1904.

762. (*Chairman.*) You are a partner in the firm of Claus & Rée, chemical manufacturers, of Manchester, I understand?—Yes.

763. I believe you hold a degree as Doctor of Philosophy of the University of Berne?—That is so.

764. You have studied chemistry principally in Germany, have you not?—In Germany and Switzerland entirely.

765. You are the Honorary Secretary of the Chemical Section of the Manchester Chamber of Commerce?—Yes.

766. With regard to the firm of Claus & Rée, they are engaged in the manufacture of aniline colours, I understand?—Yes.

767. Is that the whole of their business?—Not entirely. They are engaged in the manufacture of chemical products generally, but aniline colours are the principal thing.

768. The aniline colours represent the bulk of their manufacture?—Yes.

769. In that branch of your business do you employ any alcohol now?—Practically none.

770. At what period did your firm start in the aniline colour industry?—We have been engaged for thirteen or fourteen years in it.

771. Then, in fact, you started after the period at which one may say the decline of the manufacture of aniline colours in this country had begun?—Yes.

Alcohol for aniline dyes.

772. Have you ever used alcohol?—Yes, we have used alcohol up to within about two years.

Concession by Board of Inland Revenue for use of special denaturant for recovered methylated spirit.

773. In what form did you use it?—In the form of methylated spirits. We distilled it after using it as a solvent in a certain chemical operation, and obtained the alcohol by constant redistillation in a constantly pure form. The Inland Revenue people, who were interested in following what we were doing, considered that it would be dangerous if the alcohol as we obtained it on distilling were not rendered non-potable, so we were asked what we would suggest in the way of using the product that would not interfere with our mode of manufacture and yet would at the same time render the alcohol absolutely useless for drinking purposes. We suggested a certain product which we were using in the manufacture of a certain colour. A very small quantity of this product in the alcohol would render it absolutely non-potable. Nobody would care to drink it, and would probably poison himself by so doing.

Process given up owing to cost of methylated spirit and German competition.

774. Was that suggestion of yours accepted?—It was accepted, and we made use of that mode of procedure for quite a long period. I should like to name the reason why we ceased making use of this mode of procedure. The principal reason was that we found competition from abroad became so great that it was impossible for us to continue carrying out this process, owing to the relatively high price even of methylated spirit. There was a certain amount of loss always, and that loss, of course, went on to the cost price of the finished article and made it impossible ultimately for us to compete with the German colour makers in this particular article, which we have now ceased to manufacture.

775. Could you give us approximately the date at which you began that process of denaturing?—I am not quite sure about when we did it, but I have very little doubt there will be here somewhere, or at all events in Manchester, figures showing that. We had to apply first of all for the use of comparatively large quantities of methylated spirit. The quantities we used were never anything very great, but still they were very much larger than we had used before. No doubt we began manufacturing just about the period that we made that application.

776. (*Dr. Thorpe.*) Perhaps you could tell us whether it was before or since 1902?—It was before 1902 certainly, because as a matter of fact we gave up manufacturing this colour—I think I am not wrong in saying—certainly before the end of 1902.

777. (*Chairman.*) What quantity of methylated spirit were you using at that time?—I do not think it would be a very large quantity.

778. I gather from what you say that the reasons which induced you to give up the use of alcohol in the way you have described was, first, the competition from abroad, and, secondly, the expense of the alcohol?—Exactly so.

Process could not be resumed unless alcohol were much cheaper.

779. I presume those reasons would still influence you and prevent your resuming that manufacture?—They would prevent our resuming the manufacture of that colour to-day even in spite of the fact that alcohol is undoubtedly cheaper to-day than it was at the time we were using it.

780. Could you say at what price for alcohol it would be profitable to you to resume that business? Supposing you could get the alcohol at 1s. per gallon, would that, do you think, make the difference?—Yes, I think at 1s. per gallon we should be able to resume the manufacture of that colour with advantage to ourselves. We were at that time paying something between 1s. 10d. and 2s.

781. Do you mean for the bulk gallon of methylated spirits?—Yes, for the methylated spirit which we were buying, which, I think, would be about 64 over proof. That same product could be purchased to-day, I should say, for a little under 1s. 7d.

782. Then a difference of 6d. in the price of the spirit might make the difference to you of resuming or not resuming that manufacture?—It might, in addition to other factors. I do not say that that alone would influence us, but in addition to the other factors, I think it would induce us to take up the manufacture again.

783. At the present moment are you using any spirit?—A very small quantity—so small that it is in fact, you might say, practically none.

German competition: Influence of cartels on British aniline dye industry.

784. With reference to the German competition which you mentioned just now, that, at any rate, is more severe now than it was then and more difficult to compete against, is it not?—It is in some respects, but I do not know that it is so absolutely all round. We should have been more successful had we been able to use alcohol as the Germans and Swiss have been able to use it.

785. You probably confine yourselves to certain specialities?—Yes, we do.

786. We have had some evidence as regards the condition of the German manufacturing interests to the effect that there have been great consolidations of those interests leading to the formation of cartels, which will become very powerful adversaries?—Personally I am not inclined to think that they will be a very dangerous factor. I think that, to all intents and purposes, the aniline colour industry in this country might be said to be non-existent—I mean, it is so small and the proportion of colours manufactured in this country is so insignificant compared with the quantity manufactured in Germany that, to all intents and purposes, you can hardly take it into consideration to-day. So far from the consolidation of the German interests being inimical to the few of us who are in the business in this country, I think that possibly the Germans would be inclined slowly—not quickly—to put up their prices; and that, of course, would be helpful rather than the reverse to us by making it possible for us to compete where perhaps previously we could not do so. I know that is not the general view that is taken on this question, but that is my feeling after very carefully inquiring into the views of some gentlemen who are quite well-informed on the subject.

787. Apart from the interests of your particular firm do you not suppose that if there were any indication of a large revival of the industry in this country the German manufacturers would endeavour to nip that in the bud?—I think it would be rather contrary to their interests to raise the prices very materially, because by so doing they would give an impetus to the industry which otherwise might not be possible.

Conditions precedent to revival of aniline dye industry:—

1. Free use of alcohol.

2. Alteration in patent laws. (*See also* Qs. 850–5).

3. Change in educational system.

788. Of course you have seen that in the discussions on this subject which have taken place in Parliament and elsewhere a great deal has been made of the fact that at one time this industry was a flourishing industry in this country and has ceased to be so? The great question now is, is it conceivably possible under present circumstances that it could be reinstated as a large and powerful industry?—I do not think it could ever be reinstated as a large and powerful industry. To begin with, I do not think it ever was a large and powerful industry in this country, and I do not think it could for some generations become one unless a variety of circumstances were to happen. That is, in the first place, if we were as free to use alcohol as they are in Germany; further, if we had an alteration in our patent laws; and also if we had an alteration in the whole of our educational system. Those three factors are the ones which are generally pointed out as being the most important. I am further rather inclined to think from observations I have made that the aniline colour and allied industries are industries for which the Germans as a race are peculiarly well suited. Without wishing to detract at all from the eminence of a great many chemists in this country who stand absolutely as high as the chemists of any other country in the world, I think that the average Englishman is not quite as well suited for that particular branch of higher chemistry—just as the average Englishman is well known to be a better colonist, for instance, to point out something in his favour. That is my own view, in which I am by no means supported by many people in my own trade. I think you will find that where you have to deal in this country with the manufacture of aniline colours, the preference is given to German or German-Swiss chemists, or men who are of Teutonic descent.

Germans thought to have special capacity for this industry.

789. In addition to that, the Germans have the great advantage of being in possession of the trade at the present time?—Undoubtedly they are in possession to-day.

790. Taking those three factors which you mention—duty-free alcohol, the patent laws, and scientific education—how would you range those in order of importance; would you put the alcohol high?—I really should not like on the spur of the moment to say which of the three I should consider the most important. I think I should put last of all the alteration of the patent laws, for the reason that the aniline colours and most of colours used nowadays are no longer subject to patents. That also applies to certain products that are used in the making of those colours. In a few instances there are still patents in existence for the production of products necessary for the colours, and they would prevent an English manufacturer producing those colours at all. But in a general way I think I should class education and duty-free alcohol as of equal importance, and then only I think would come in the question of the alteration of the patent laws.

791. In the case of the other chemical products with which your firm are concerned, do you use alcohol to any great extent?—We do not.

792. Not at all?—Not at all.

Uses of alcohol in industrial undertakings:—
1. As a medium for reaction.

793. In your *précis* you mention four methods in which alcohol might be employed in connection with industrial undertakings, the first being merely as a medium in which different bodies were to react upon one another. Would you give us an example now of an industry in which alcohol would be used as a medium?—It is used as a medium in the case of that product which we manufactured. We allowed two products to react upon one another in alcoholic solution. It is necessary to have some medium for those two products to react upon one another, because otherwise the reaction would be so violent that in the final product instead of the reaction stopping where you wanted it to stop it would go on beyond that, and you would simply get a mass of useless products. That applies to a great variety of different processes that have to be carried on, not only in the aniline colour industry, but in the allied industries, such as perfume manufacture. I do not think it applies in the case of saccharin, but it certainly does in the case of pharmaceutical products.

794. For that particular purpose are there certain industries in which very large quantities of alcohol would be used?—There are.

795. Then going on to your second head, you say that alcohol may be used industrially with the object of converting a certain chemical product into another by bringing about an actual chemical reaction between the alcohol and the other product?—Yes. But might I revert for one moment to the first head? I have said very large quantities were used, but, of course, they would not be anything like as large quantities as would be used in the other forms, because where you are using the alcohol as a medium you would re-cover most of it, and therefore you would not really make use of a very large quantity actually unless there were a material loss. When using alcohol as a medium it does not, therefore, play as important a *rôle* as if you were actually introducing the alcohol radical into another chemical substance.

796. Would you say that only a comparatively small percentage is lost on each operation?—It would depend upon the operation and the plant that you used. The percentage of loss in the case that I was thinking of in our own particular experience would not amount to, I should say, more than between 10 and 15 or at most 20 per cent. of the alcohol used. *See also* Q. 915–20.

797. (*Dr. Thorpe.*) In the particular case which you have quoted you have stated that there was nothing in the methylated spirit which made it unsuitable or detrimental apart from the price?—In this particular case there was nothing seriously detrimental, but it was detrimental to this extent—that the yields we could obtain by using methylated spirit rather than pure alcohol would not be quite so good. In a good many organic reactions, the presence of the methyl radical rather than the ethyl radical leads to the formation of tarry products. For some reason or other is there not a far greater tendency, if methyl alcohol be present, in a good many reactions for the formation of tarry products?

798. In this particular case are you sure that it was the methyl radical and not the power which acetone has of bringing about the formation of condensation products?—In this particular case the loss to us of using methylated spirit rather than alcohol was so slight that I should not like to lay great stress upon it.

799. Even where the loss did occur you are not able to assure yourself that it was not really due to the accidental presence of acetone?—That I would not like to make a definite statement about.

2. As a constituent of the product, in the form of ethyl or methyl radical.

800. (*Chairman.*) Reverting now to your second head, that is where the alcohol radical is incorporated in the final product as a constituent element. In certain of the colours, I understand, that is necessary?—It is, in certain of the

Dr. A. Rée. — 22 Nov. 1904. — colours, and in certain of the products used in the manufacture of the colours. There are a very large number of aniline colours that are produced from what are known as dimethyl aniline and diethyl aniline. Those two products have to be prepared from aniline with either methyl alcohol or ethyl alcohol, and they cannot be produced in this country at all. We use quite a considerable quantity of the dimethyl aniline, but we have to get all of it from abroad. The large aniline manufacturers in this country would be very glad indeed if they could produce this article for which there is quite an extensive sale, but they are prevented from doing so owing to the restrictions on the use of alcohol.

(3) For extraction and purification, *e.g.* in purifying fats.

801. Your next head is the use of alcohol for the extraction and separation of one or mere products from one another; does the alcohol come in in that form in the articles in which you deal?—Not in the products that we deal in particularly. I do not know that I should be right in referring here to a manufacture we had intended taking up when we started thirteen years ago, namely, the purification of coco-nut butter, by means of alcohol—extracting from that butter certain products that are of disagreeable taste, and leaving fat that was useful and pleasant for edible purposes. We had worked out a process of carrying this out, and we were deterred from taking it up on account of the expense—at that time particularly, but it would still apply to-day—of pure alcohol, which was absolutely essential for the process. I may say that two or three years after the same process was discovered in Germany, and was carried out on a large scale, and has led now to a very important industry which is likely to become almost as important as the aniline colour industry. The process has been amplified and made use of in the purification of a great variety of other fats. That is an industry which it would be absolutely impossible to carry out here, and I expect that before very long we shall be importing into this country, if we are not doing so already, quite a large quantity of pure fat, or at least of fat that is edible and pleasant to taste, which has been manufactured from fat that is not so, by the extraction with pure alcohol, and the removal thereby of the products that are disagreeable to the taste.

Methylated spirit deemed unsuitable for this purpose. (*See also* Qs. 857–61, and 911–4.)

802. When you say you were deterred by the cost of the alcohol, do you mean that at that time it was necessary for you to use duty-paid alcohol?—Yes, we should have had to pay the duty. We should have had to use pure alcohol in any case. We could not have used methylated spirit there, because methylated spirit would have made the fat perhaps even more disagreeable to the taste than it previously was.

803. Would any of the spirit remain?—No, none at all.

804. Would its flavour remain?—The flavour of the methylated spirit would remain, because I should say almost certainly that that which you add to alcohol in the production of methylated spirit to make it as unpleasant as possible to the taste, would be liable to give that taste also to the butter or the fat, if the butter or fat were in any way brought into contact with the methylated spirit.

805. While on the subject of that, there is a considerable manufacture of margarine in this country, is there not?—I believe there is.

806. Do they require alcohol for that?—So far as I know they do not make use of alcohol at all. I do not know very much about the manufacture of margarine, but I feel pretty confident that no alcohol is used there.

807. I presume you are aware of the Act of 1902?—Roughly, yes.

Finance Act, 1902, s. 8; its adequacy to meet the case of such processes.

808. Since that Act of 1902, if it could be absolutely proved that methylated spirit was not suitable it would be possible with the consent of the Board of Inland Revenue to obtain pure spirit duty free, provided the Board of Inland Revenue were satisfied that it was necessary, and, further, were satisfied that arrangements could be made which would prevent leakage of the spirit. Let us assume that you were again in a position in which you wished to undertake this manufacture, and you came to us and said you required pure spirit, and we were willing to allow it on condition of suitable arrangements being made for its use for that purpose and no other: would it be easy, do you think, to devise means of preventing leakage of the spirit?—I think it would. While I am not prepared to say what would be the best mode in each particular case of procedure, I should like to suggest that, if it were really contemplated to bring about greater facilities in the use of pure alcohol in this country for industrial purposes, some gentlemen who would be suitable to do so should go abroad and inquire carefully into the means that are used in Germany, let us say, for preventing pure alcohol beng used in any other way than what it is intended to be used for. I think the probability is that there would be no difficulty in obtaining full particulars as to the way in which the Germans or the Swiss deal with that particular question. I think that they are quite satisfied that there is no loss to themselves in any way whatever through the use of that pure alcohol.

Excise supervision necessary with pure duty-free spirit. (*See also* Qs. 862–71).

809. It rather depends upon the circumstances of each particular manufacture; you may sometimes be manufacturing a thing in which it would be very easy to control the use of the spirit, and there may be other manufactures in which every workman concerned may have to be supplied with a given quantity of spirit to enable him to carry on his business, and in these latter cases there would be a difficulty?—I should say that means might be devised to overcome that difficulty. Only a limited number of men might be allowed to handle the alcohol, and then there should be a certain liability in accounting for the alcohol; the whole operation should be conducted in places that are locked, and a mode of procedure might be employed similar to what I suppose is adopted in the Mint to prevent the workmen carrying away any of the valuable metals. Locked stills could be used and also locked receivers.

Practical application of purified fats.

810. Is this application of alcohol for extraction or purification of fats a comparatively new process?—It is a comparatively new process. I think it has only been carried on for a little more than ten years.

811. Is the process applied to all sorts of animal and vegetable fats?—It is, I believe, applied to animal fats now, but originally the first experiments that my partner and I made were with coconut butter.

812. In order to produce coconut butter is the use of alcohol absolutely necessary?—I do not say that it would be absolutely necessary, but I do not know of any product that would be so suitable for the removal of the objectionable products in coconut butter as alcohol would be.

813. In the manufacture of cocoa, the cocoa butter is produced automatically as a by-product, is it not?—I believe so.

814. And in very large quantities?—I should think it would be.

815. And many people consider it rather a delicacy, I believe?—As such—I mean without any purification?

816. Without any purification; it is used for sweetmeats and things of that sort?—It might be used for sweetmeats where it is desired that there should be a particular flavour, but it could not be used for the ordinary cooking purposes, for which the use of the fat would be far greater than it could possibly ever be for sweetmeats.

817. What elements does it now contain as it comes away from the ordinary manufacture of cocoa which unsuit it for that, and which you want to remove by means of alcohol?—Products of a comparatively acrid taste. Their chemical constitution would probably be varied and not confined to any one substance. I should say that probably that which is objectionable in coconut butter would contain, amongst other products, substances similar to acroleine, which would be very disagreeable and have a very acrid taste.

818. That is one specimen of the kind of fats that are to be found; can you mention others, and tell us, when they are purified, what becomes of them?—The fat from beef or mutton can be purified in that way, and can be used for edible purposes, and would fetch a better price than it does when not so purified.

819. Even without that purification those fats are now made use of for margarine?—They could be used in larger quantities, and would fetch better prices if the purification could be carried on by the aid of alcohol. I believe Dr. Ormandy, who will follow me to-day, has gone into this question very thoroughly indeed, and will probably be able to give you far more information on the subject than I can.

(Uses of alcohol) (4) as a solvent, chiefly for perfumes.

820. Your fourth heading is the use of alcohol as a solvent for certain products where the solution so prepared is an article of commerce. That was originally the main manner in which it was used in connection with the aniline dye industries, was it not; that is, so far as the aniline dye industry was concerned it was principally used as a solvent?—Yes, in the old days it was, when quite a number of colours were not soluble in water, and alcohol was used to keep them in solution.

821. But now you say it is not so much required for that particular industry?—It is required to a very minute extent only in that case. I should say that it is used very largely in that way for perfumes and products of that kind to-day.

822. Then you say in your *précis* that the use of alcohol for the manufacture of many products of chemical industry is a *sine quâ non*; then you give a reason, and you add that you can give an illustration from personal experience of the loss to this country of a highly remunerative and very important industry owing to the excessive price of pure alcohol. That is the case we have just been discussing, I take it?—Yes.

Purification of fats. (*See* Q. 801, etc.)

823. Do you think that industry might have assumed very large proportions?—I think England would have been peculiarly suitable for the carrying on of that industry, always assuming that alcohol could have been used equally advantageously as it is in Germany. I believe that we are suited in this country for the carrying on of chemical industry generally. I do not wish to imply by any means that what I said previously with regard to the aniline colour industry and similar industries applies all round. I believe that the heavy chemical industry can be developed with great advantage here, because I think that the average Englishman is probably a more practical person generally than the average German; and in the heavy chemical industry that is a very important factor indeed nowadays.

824. In reference to the next paragraph in your *précis*, I think it may be admitted that in many chemical operations pure spirit is absolutely necessary; but the question is in how many cases. When we come to detail we want to know where it really is absolutely necessary and where it is not. Apart from the question of the protection of the Revenue, every one would prefer to use the pure spirit rather than methylated spirit, if it was only for the sake of their own noses; but there are a very large number of chemical industries in which methylated spirit can be used, so far as the character of the spirit is concerned, with very good effect. Take, for instance, such a thing as varnish making; there is no very serious objection to the use of methylated spirit in varnish making, is there?—I should think not. The only objection to the use of methylated spirit in chemical operations in organic chemistry is the one that I mentioned to Dr. Thorpe just now with regard to the danger of the formation of tarry products from alcohol containing the methyl radical rather than the ethyl radical.

Methylated spirit not always unsuitable, as regards character, for chemical operations.

825. Therefore, it really must depend upon the precise conditions and requirements of each industry, whether or not pure spirit is necessary, and whether or not methylated spirit is detrimental or unsuitable; and it is impossible to make any general statement as regards it?—It is very difficult indeed to make an absolutely definite statement in that way. I am thinking of the aniline colour industry. Each individual case, one might say, would have to be investigated separately. I should think that there are quite a number of cases where methylated spirit would do as well as pure alcohol. I am speaking now upon the question of impurity only, and not upon the question of the cost. It would be undoubtedly so much better and so much simpler for the aniline colour manufacturer if he could use a pure alcohol without any greater cost than if he used methylated spirit, because the re-actions on using methylated spirit are complicated in so many cases; he has present a certain quantity of other products which with pure alcohol are not present at all, and they might easily complicate the re-actions that would take place.

826. Even where the methylated spirit is not unsuitable, still it always has the disadvantage of the increased cost?—That, undoubtedly, is one very grave disadvantage.

827. There again what the measure of that disadvantage is depends very much upon the quantity of spirit used in producing a given quantity of the article manufactured?—Yes.

828. I think you have already told us about the next point in your *précis*—the special method of denaturing which you found suitable, which was authorised, but which you had to give up?—That is so.

See Q. 773, etc.

829. Then in your *précis*, having referred to the purification of fats, you mention the manufacture of vinegar; is pure alcohol required for that?—I should say the purer the alcohol the better would be the vinegar obtained. If you want to produce vinegar, and use methylated spirits for the purpose, I should say that the probability is that you would obtain a vinegar of a disagreeable taste. I should not like to state definitely that that is so, as I really am not acquainted with the fact.

Alcohol for making Vinegar

830. There are various ways of making vinegar now, are there not; for instance, there is the malt vinegar?—Quite true; there are a good many different ways of making vinegar. The manufacture of it from alcohol is, I believe, carried on pretty largely in Germany in the present day.

831. Have you anything to say on the subject of the use of alcohol for lighting and heating purposes?—No, I have only enumerated that. I believe Dr. Ormandy will be able to say a great deal more about that than I can.

Alcohol for light and heat. Cheapness essential

832. As regards the relative advantages of alcohol for lighting and heating, is it not probable that there would be much less inducement in this country to use alcohol extensively for lighting and heating than there might be in other countries where they have not the same abundant supply of coal?—I do not think that that would apply altogether, because alcohol can be used in cases where coal cannot be used.

833. Take lighting purposes, in Germany they use alcohol very largely in place of gas, do they not?—They do now.

834. Do you suppose it is at all likely that in this country we shall ever wish to substitute lighting by means of alcohol for lighting by means of gas?—Certainly not, if we have to pay as much for it as we do to-day, but if we should be able to get it as cheaply as they get it in Germany I see no reason why it should not come into use in many cases of heating, for lighting and for motive purposes, where we could not possibly use it to-day. The production of alcohol in Germany is very great indeed to-day, and probably will be greater with the improved means of manufacturing it from wood, which seem to be coming to the front more and more. I believe it is possible now already to obtain from one ton of wood something like thirty gallons of 90 per cent. spirit.

Production of alcohol from wood.

835. Is that being largely used in Germany?—I do not think that that is already a subject of large manufacture, but it is one that has been taken up and is very likely to develop materially in the future.

836. Have you given any attention to the use of alcohol for motive purposes, more especially in motors?—No.

837. Therefore you do not speak to that?—No, I think there again my successor in this chair will be able to say a great deal. I think he understands a great deal about that subject.

838. Then you refer to agricultural interests, but the Committee do not consider that that is quite within their Terms of Reference; it is rather a consequence that might ensue from the large use of alcohol than concerned with the preliminary question of how that large use could be facilitated. You mention in your last paragraph that efforts have been made to obtain the removal of the hindrances to the unrestricted use of pure alcohol industrially for a great many years; could you give us any description of those efforts?—I believe Chambers of Commerce have in the past addressed communications to the Inland Revenue Authorities on the subject; the Manchester Chamber of Commerce, I think, has done so particularly of late years.

Efforts made for removal of hindrances to use of alcohol.

No concerted action by traders in the past.

839. The matter was a good deal discussed just immediately prior to the passing of the Act of 1902; I have not, of course, made a very exhaustive investigation of our records, but the impression on our minds is that until quite a short time before 1902 we had not many representations made to us on the subject?—Then that must be a mistaken impression on my part. I was under

Dr. A. Rée
22 Nov. 1904.

the impression that that had been done. I think that in the journal of the society of chemical industry alone, I should be able to find references to applications that have been made to the Inland Revenue authorities on several occasions previous to 1902, and since with this particular object.

840. Particular manufacturers have applied to us, but I could not say that up to 1902 there was any evidence of an organised movement in order to obtain great facilities for the use of alcohol?—Then I must have been in error.

841–2. (*Dr. Thorpe.*) I have been here since 1894, and I am quite sure that any substantial or important application of that kind would have come under my notice. Although it is, as the Chairman has stated, perfectly true that in a few individual cases applications may have been made to the Board, certainly nothing like an organised attempt on the part of traders, either through Chambers of Commerce or in any other way, has come to the notice of the Board. They have been the efforts of single firms only, then?—Yes, I think, probably, Mr. Tyrer would be more fully acquainted with the matter than I am, but I was certainly under the impression that both in London and in Manchester concerted efforts had been made, and had they been made they would doubtless have reached you here.

843. (*Chairman.*) Speaking quite generally, beyond what we have talked about to-day, can you suggest any other industries, or classes of industry, which are at present hampered by the want of duty-free alcohol?—I do not think I can. You can include amongst the aniline colours industries the allied industries for the production of pharmaceutical products of an artificial synthetic character, or the production of perfumes and artificial sweetening agents and products of that kind, and, of course, these cases that I have named. I do not think I could recall at the moment any other industry that would materially benefit by the unrestricted use of alcohol industrially.

Alcohol from wood. *See* Qs. 834, and 1057–66.

844. (*Mr. Scott-Montagu.*) I was rather interested in your remark as to making alcohol out of wood. Is that alcohol made out of sawdust, or the refuse of some other manufacture, or is it made out of the wood as it exists in the raw material?—I do not think that the mode of procedure has been published, but I should say that in all probability it is made from sawdust. I am sorry to have to refer you so often to Dr. Ormandy, but I think if you ask Dr. Ormandy that question he will probably be able to give you far more particulars than I can. I can only just mention the plain fact that that point has been reached, that thirty gallons of alcohol can be obtained from a ton of wood.

845. Do you think it would be possible, so far as you know, to remove the restrictions on the use of pure alcohol without endangering the revenue?—I think there is no doubt about it. If in Germany they have been successful in removing the restrictions without any serious loss, I do not see why it should not be possible here. It seems to me that they are interested in Germany, perhaps not quite to so great an extent as we are here, but still to a very material extent, in preventing the use of this alcohol for any but purely industrial purposes.

See Q. 780.

846. (*Mr. Tyrer.*) I think I understood you to say that if alcohol were one shilling per bulk gallon that would enable you to compete?—Yes, I think that would enable us to take up the manufacture of that article again.

847. I wanted to be quite clear on that—you meant that particular article?—Yes, quite so.

848. Notwithstanding the fact that it is said that alcohol of the same strength is cheaper in Germany than a shilling per bulk gallon, that price would enable you to compete?—I think it would, combined with certain other factors.

849. And with the price the same as in Germany?—Yes; that would be all the better.

Patent Laws. (*See* Q. 788). Relatively few colours now subject to patents.

850. You have referred to rather an interesting point, namely, the patents. As I understood you, very few patents are being taken out now?—Relatively few colours are now subject to patents. If you take the total amount of aniline and alizarine colours used to-day in the world you will find the proportion that are subject to patents in any way whatever will be a relatively small number both in weight and variety.

851. To what do you attribute that?—To the fact that a very large number of useful colours that are employed to-day were discovered so many years ago that the patents have naturally lapsed.

852. The development of possible colours is not at all in a mathematical ratio?—I do not think that to-day, if you except the single case of indigo, there are many very important colours that are being used to any very material extent that are the subject matter of patents. Of course, there are quite a large number still subject to patents, but they are few in comparison with the immense number that we use to-day which are no longer patented.

Colours requiring alcohol. Quantities produced probably not less now than in the past.

853. In that connection I at least have gained the impression from the evidence that has been presented to us that to-day the colouring matters containing the ethyl and methyl radicals are not so numerous, nor are they produced to the same extent as they used to be; is that, in your opinion, the fact?—I should be inclined to say that there are quite as many colours used to-day in which alcohol has to be used for the purposes of a medium or where the alcohol radical is introduced into the nucleus. I am inclined to think that colours such as those which are known nowadays as methyl violets, for instance, and the brilliants and malachite greens are manufactured quite as largely as they were ten, or fifteen, or twenty years ago. It is true that certain colours are not used quite as largely as they used to be, but I am very much inclined to think that if you were to apply to the principal makers of aniline colours in Germany to-day, you would find that they produce at least as much of those products to-day as they did ten, or fifteen years ago, and probably more.

854. I take it that, in your opinion, the patent law question is not so responsible for our difficulty as some have made out?—Not to quite the extent that some people would hold, so far as the present is concerned, whatever it may have been in the past.

See Q. 788

855. Certainly it cannot be, in view of the decrease in the number of patents in existence. But you do hold very strongly that the supply of duty-free alcohol and the education question hold about an equal position as accounting for our present position with regard to these industries?—Those two factors I regard as approximately of equal importance.

856. Combined with national peculiarity?—Yes; that I make rather a strong point of.

Methylated spirit for purifying fats—too expensive, apart from any question of its character. *See ante*, Q. 801–4, and *post*, Q. 911–4.

857. With regard to the question of flavour, do you feel quite certain that the use of methylated spirit as at present methylated or denatured would be a detrimental element in the application of methylated spirit to dyeing and to pharmaceutical and other synthetic preparations, in which the taste, or the odour, or the absence of taste or odour, was a factor in the final result?—I have endeavoured to be absolutely candid with you, gentlemen, and therefore I would like to say that I have no actual practical experience that the use of methylated spirit in the purification of fats would produce an article that would be unpalatable. The only grounds which I have for making such a statement are that fat is peculiarly liable to take the taste of any product with which it is brought into contact—either actual contact or even approximate contact—and therefore I take it that if you are going to use for purifying a fat, a product like methylated spirit, which has been purposely rendered non-potable, or rather disagreeable to the taste, you are going to introduce into that fat that very flavour which you are purposely using in the alcohol to make it non-potable, and therefore you are going to do the very thing which is least desirable. But that is merely theoretical, and I should like to say that I have never actually tried to use methylated spirit as made to-day for such a purpose.

858. (*Dr. Thorpe.*) Let me remind you that you pointed out to us that the whole industry had been jeopardised, and that, in fact, it was non-existent, whereas apparently no effort was ever made to make use of methylated spirit?—No effort was made to make use of methylated spirit itself; but even methylated spirit could not have been used in the instance I gave, because of its high price.

859. That is another matter; we are speaking now of the actual character of the spirit?—Primarily our invention was that by extracting by means of pure

alcohol from cocoanut butter various products that were unsatisfactory, you could obtain an article that would have become an article of commerce, and could have been used as such. That methylated spirit might be used I admit, but it could not be used in this country, because even methylated spirit would be too expensive to use for that purpose.

860. (*Mr. Tyrer.*) In that connection I will put a hypothetical question to you so as to get directly at the point. As you contemplated some years ago treating fats of various kinds, one of which you have mentioned, with pure alcohol, for the purpose of complete purification and rendering it edible, did this occur to you in the course of your experiments.—While methylated spirit certainly will not do, I will see what modification of pure spirit would do; in other words, did any alternative method of denaturing occur to you as suitable for such a purpose?—It is some eleven or twelve years ago, and I cannot recall for the moment that any such thought did enter our minds. I should not like to speak for my partner in the matter, but it certainly did not occur to me.

861. May I put it in another way. Supposing the question arose *de novo* to-day, you would naturally seek about for an alternative denaturant, so as to enable you to avail yourselves of the provisions of the Act of 1902?—Certainly.

Extent of excise supervision necessary, under Finance Act 1902.

862. Supposing that were accomplished by means which secured the protection of the Revenue and the Government with regard to the administration of the Act, what would be your views specifically on the question of supervision? Take the particular industry to which you have referred; of course you would rather have no supervision, but what would be the kind of supervision which you think would adequately meet both sides of the case, looking at that fairly all round, having regard to the circumstances of the case from the Revenue point of view, and from the industrial point of view; in other words, which would be the least inconvenient to you or to the manufacturer and, on the other hand, would conserve the interests of the Revenue?—I think you put the question having regard to the use of an alcohol that has been denatured with a product that I could not object to?

863. Yes?—I should say that the alcohol should be introduced into a works of that kind in relatively large quantities at a time in sealed drums, and should be denatured on the spot in the presence of a revenue officer and in a manner that would not be opposed to the interests of the particular industry. Further, if that has to be recovered, that immediately after the alcohol begins distilling over from the stills in which you recover it, a certain proportion of that denaturant should be put in to the receiver into which the alcohol runs.

864. In the presence of an officer?—Yes.

865. That does not go quite so far as I thought. In the present case of methylated spirit you are subject usually to heavy bonds, and so on, but the supervision is casual—that is to say, the officer can come in at any reasonable time he likes, and if he has any reason he can come in at unreasonable times?—Quite so.

866. Do you think that under those circumstances it is necessary for a residential or a permanent officer to be present?—I hardly think so. I should like to say that in a matter of that kind one might perhaps to a very large extent be guided by the experiences of those countries where alcohol is used in that way and has been used in that way for so many years. Their interest it is, quite as much as it would be with the Board of Inland Revenue, to safeguard the use of the duty-free alcohol and to prevent its being used for potable purposes; and they must have some system which they find works well in a general way, but which has to be modified possibly in individual cases; and that system very probably we could adapt in this country with advantage to all parties concerned.

867. Have you, directly or indirectly, any experience of the amount of supervision and the kind of supervision exercised on the Continent?—I have not sufficient to be able to give you any information on the subject, I believe my partner probably could give you some information.

868. (*Chairman.*) Of course, you recognise the immense difference there is between a country in which the duty on spirit is 11s. per gallon and a country like Germany, where the duty on spirit is 1s. 9d. per gallon—what is worth doing in one country is obviously not worth doing in the other?—That, I take it, is one of the principal reasons why it has not been done here.

869. (*Dr. Thorpe.*) I think you must also, from your knowledge of the Continent, know that the relative proportion of the people who drink spirits and beer is very different in the two countries; is the German artisan in the habit of drinking spirits to the same extent as the English artisan?—I am afraid I should not like to commit myself there. I must say that in a general way one would be rather inclined to agree with what you put, but there are certain parts of Germany and certain parts of Holland, and certain parts of Belgium, I am sure—and of France also—where the quantity of spirit consumed by the working men must be very nearly as great as that consumed in this country.

870. Holland is a singularly unfortunate case, because there are practically no chemical manufacturers using alcohol industrially in Holland?—Do they not use it for the purification of fats? I think that is one particular industry in which Holland has been remarkably successful.

871. As regards edible facts—butter substitutes—that may be so; but so far as regards chemical manufactures in general, you cannot point to any instance in Holland, can you?—No, certainly not in Holland.

Increased cost of spirit due to expense of methylation a serious disadvantage in certain industries.

872. (*Mr. Nicholson.*) I want to ask you about the cost of methylating. On one or two occasions you have said you were prohibited from using methylated spirit on account of the cost. Comparing that with the use of pure alcohol, assuming you could get pure alcohol free of duty, it would be very much better than methylated spirits, would it not, on account of the cost?—On account of the cost, and also on account of its being so much better for people working with organic chemicals, to use a pure article rather than an adulterated one. Apart from that, however, I understand you to want to know what I mean by saying that the methylated spirit would be an expensive product to use? The methylation itself adds to the expense of the alcohol necessarily.

873. To a large extent?—Not to a large extent, but to a material extent.

874. About 2d. per gallon, is it not?—Yes. I do not know what it is exactly, but even if it be only 2d. per gallon it seems a grave disadvantage that a chemical manufacturer should have to use an article and pay something like 15 to 20 per cent. more for it than there is any need for, in addition to which he is under the disadvantage of using an impure article.

875. Do you say that 2d. per gallon means a grave disadvantage?—It would not in some industries amount to so grave a disadvantage as it might in others. As I was saying to Mr. Tyrer, I think we might take up the manufacture of certain colours again if we could buy alcohol at 1s. per gallon, where previously we had been paying 1s. 10d., or even 2s., but it would be still better for us if we could buy it at about 9d.

Cheapness of spirit in Germany due to State aid.

876. In answering two or three of the questions of the Chairman, you said that if you could obtain alcohol as cheaply as they can get it in Germany, our competition would be largely increased; you are aware, of course, that the price of the spirit in Germany is very low, and that, in fact, in some cases it is below cost price?—I was not aware that it was below cost price.

877. Part of the duty in Germany is devoted to, so to speak, subsidising the industrial use of alcohol, and in cases the alcohol is sold below cost price?—Does the manufacturer obtain from the Government some concession in return for so doing?

878. That is what it amounts to. Therefore it would be rather a Utopian hope would it not?—To obtain the alcohol quite as cheaply as they get it in Germany under these artificial conditions, yes. That certainly complicates the question somewhat. But, on the other hand, is that condition of things likely to continue for any length of time in Germany, any more than their bounty system on sugar did? That does not appear to have been an absolute success, from many points of view, and possibly they might abandon the system in the case of alcohol as well.

879. As things stand at present, it would appear rather hopeless, unless this country was prepared to subsidise

Dr. A. Rée.
22 Nov. 1904.

alcohol in the same way ?—Is that not a case of a relatively very small figure ?

880. Not, I think, when you tell me that a difference of 2d. per gallon in the cost of methylating is such a grave difference ?—It might be in some industries, but not in others. I do not think, for instance, that in the aniline colour industry that 2d. would be a factor of very grave importance.

881. With reference to the aniline dye industry, can you give us any figures as to the amount of spirit which is used in Germany in the trade for that purpose ?—You are asking for the figures in connection with the aniline colour industry alone ? Those I could not give you ; but it is known what is the quantity used for the industrial purposes.

882. In Germany, I think, they do practically about nine-tenths of the aniline dye trade of the world, do they not ?—The German aniline colour manufacturers, I think, do quite that, and I should say that probably in the future they will do rather more.

Colouring matters made by witness' firm. None directly require alcohol.

883. (*Dr. Thorpe.*) Kindly tell me what main groups of colouring matters your firm make ?—I cannot say that we confine ourselves to either basic colours or acid colours. We do not make alizarine colours.

884. Do any of them belong to the group of azo colouring matters ?—They do.

885. Does any considerable portion of them belong to that group ?—perhaps 30 to 40 per cent.

886. Perhaps a third of them ?—I think so, but it is quite a guess.

887. That is a group of colouring matters in which practically alcohol and alcohol derivatives play no part ?—Quite so. In the production of certain direct dyeing colours of very material importance, alcohol does enter into the manufacture of the intermediate products used in their production.

888. Do you mean, for example, dimethyl aniline ?—I was thinking in this case more particularly of the production of what are known as direct dyeing blues, into which the alcohol radical enters. They are direct dyeing colouring matters that are very largely produced, although we do not produce many of them here.

889. The impression you gave the Committee was that practically alcohol does not directly enter into the composition of anything that you make now ?—That is so.

Main factors in decadence of British Aniline dye industry. *See* Q. 788–790.

890. You have told the Committee what, in your opinion, are the three main factors which have led to the decadence of the aniline dye industry in this country ; you have enumerated them as alcohol, education, and patent laws ?—And the question of national characteristics.

891. Yes, that makes four factors. You did not exactly specify the particular place where the national characteristics came in, but certainly of the first three which you mentioned, you put the patent laws as third ?—Of the three that I specified, the patent laws, education and alcohol, I said that the patent laws, in my estimation, were the least serious factor.

892. In your judgment, the alcohol and education were very much on a par ?—Yes.

893. In fact, as to their relative position you were not able to differentiate between them ?—You have put this question to me, but I have hardly had occasion to decide sufficiently as to whether I would put the alcohol first or the education question first. That is why I said I would rather put those pretty much on a par.

894. Perhaps it is rather academic, and we need not waste much time about it, but I think, if I had the time, and the Committee had the patience to permit me to grapple with you on the question, we should come, both of us, to an agreement as to where the education was to be put ?—Very possibly.

See ante, Q. 788.

895. Now as to the racial characteristics—I need hardly remind you that the industry originated here ?—Yes.

896. And that the persons who originated it were Englishmen ?—Yes.

897. Men like William Henry Perkin, Edward Chambers Nicholson, Mansfield, Medlock, Noad, and people of that type—what racial characteristic was it that made those men do this ?—In those days the industry was not developed to anything like the extent that it is to-day. The reason why those were the pioneers of the industry is probably that the Englishman is an intensely practical person, and in those days the discoveries that were made were the discoveries that would be likely to fall to a man who was a very practical man. In those days theoretical training was of relatively rare achievement. I believe—and I think I laid great stress on that factor—and undoubtedly it would be a piece of impertinence and a piece of folly on my part not to lay great stress on that factor—that there are quite a number of brilliant English chemists who stand absolutely as high as the best chemist in any other country. But I believe that the average German, in addition to having great facilities for receiving a good education right away from the beginning and up to the very highest point has the natural advantage of being peculiarly suitable for pursuing a highly complex theoretical subject, like that part of chemistry which is needed for carrying on the aniline colour industry and allied subjects. The average German is far more likely to pursue a complex problem that is presented to him in that industry with patience, and with no immediate view of making money out of his work, than an Englishman is willing to do. I think, if you were to ask the medical profession in this country what their opinion is about that subject, they would give you—if they knew something about the way in which Germans pursue medical science—very much the same verdict—namely, that the average German is willing to work away at a theoretical subject with no immediate gain pecuniarily in front of him, far more than the average Englishman would be willing to do. The average German is more likely to have a love for his science, as such.

Secret of German success.

898. As regards Germany, how does it come about that the persons who find the capital for these industries have found the capital, because many of them are not men who are professional chemists ? The persons, for instance, who found the finances for such an organisation as the *Badische Anilin und Soda Fabrik* were not themselves chemists, were they ?—No, but they were men who had a far higher idea of the advantages of science, who were willing to find money for the pursuit of an industry where science plays a very important part. The Germans have been successful in the past, and are likely to be successful in the future, even beyond what they have been recently, largely because their large works are standing to-day in their books at very small figures indeed, compared with what some of our earlier manufacturers would have their assets standing at in their books. German firms like the *Badische* and Bayers—in fact, the most successful firms there—have, I think, made it a rule for many years to write off their assets very handsomely indeed. Take the *Badische* for instance ; if the value of their plant and buildings were estimated in a similar way to what some firms have done in this country, they would be standing in their books to-day at £6,000,000 or £7,000,000, instead of very little over £1,000,000.

Dimethyl aniline, reasons for non-manufacture in this country.

899. I should like to pursue this, which interests me as an educationist, as well as an Inland Revenue officer, and as a member of this Committee, and I have not the slightest doubt that we should find ourselves in sympathy on a good many points ; but we must turn to another matter. You have referred to the necessity of dimethyl aniline as an intermediate product ; what embargo has the Inland Revenue, or anybody, put upon the manufacture of dimethyl aniline in this country ?—This embargo—that the cost of the alcohol that would be used would be such as to make it impossible for the aniline maker in this country to produce dimethyl aniline or a dimethyl aniline at all.

900. Let us confine ourselves to dimethyl aniline ; how has the Inland Revenue, in this particular case, artificially enhanced the price of that ?—I believe, to begin with, that it is impossible for anybody to make use of pure methyl alcohol in this country to-day at all industrially.

901. Is it not a matter of common knowledge among chemists in Manchester, that the Clayton Aniline Company, as far back as 1897, obtained the concession to use practically pure methyl alcohol for the manufacture of dimethyl aniline ?—Then they must have found, if the got that concession, that the cost to them of that pure methyl alcohol was so great that they could not possibly compete with Germany in the manufacture of the finished product.

902. That may be, but that was not the fault of the Revenue authority, was it ?—Would there not be a duty on the methyl alcohol ?

Effect of the surtax.

903. The sole thing that remained was the surtax, but this Board had no power to remove that ?—The surtax would be 5d., and that would amount to a very considerable sum on the pure alcohol, would it not ? Would it not represent something like 9d. or 10d. per gallon on the pure alcohol ?

904. (*Mr. Scott-Montagu.*) What is the 5d. that you mentioned ?—The 5d. is on the proof, but it works out at something like 9d. on the pure alcohol. That would have been absolutely sufficient to prevent the Clayton Aniline Company from manufacturing that article in competition with the Germans.

905. (*Dr. Thorpe.*) Do you think it was the question of the surtax which altogether prevented the possibility of their making it ?—I think so ; I have no personal information as to whether that was the reason, but it seems to me extremely probable, knowing the price at which dimethyl aniline is sold from Germany to-day, or was sold in those days, and also taking into consideration this surtax of 9d.

906. May I ask what you pay for dimethyl aniline to-day ?—The price to-day is a little higher owing to the price of aniline, than it was formerly. It is to-day about 22d. per kilo.

907. That would be a little over 10d. per pound ?—About 11d.

908. Are you in a position to say that if the surtax were taken off, the English maker could make dimethyl aniline at 10d. or 11d. per pound ?—I have no reason to assume that he should not or that he could not. I think the Clayton Aniline Company were able to make aniline in competition with the Germans, and I think they would have no difficulty in making dimethyl aniline either.

909. Would they have no difficulty commercially, do you mean ?—Yes.

910. Is it your opinion that the 9d. was a deterrent ?—That is merely my opinion. I do not say that is so, because the Clayton Aniline Company have not given me any information on that subject. I believe, as a matter of fact, that Dr. Dreyfus, who is the principal manager of it, is going to give evidence here before you.

Manufacture of cocoa-nut fat., *See* Q. 801, and 857–9.

911. You made a reference to an industry which at one time you were a little interested in, namely, the manufacture of cocoa-nut fat. That, I understand, you were prevented from carrying on, first owing to the unsuitability of the methylated spirit, and then even apart from its unsuitability, the high price of it ?—Yes.

912. Are you aware that cocoa-nut fat is made in the neighbourhood of London, and is obtained in some such way as you indicate ?—I certainly was not aware of that fact. How long has that industry been proceeding ?

913. Some years, now ?—Is it of any magnitude ?

914. It is of considerable magnitude. May I tell you that methylated spirit is used in that extraction, and that it is not found to be unsuitable or detrimental ?—I am very pleased to hear it.

Loss of alcohol in manufacture *See* Q. 796.

915. (*Dr. Somerville.*) In your examination-in-chief I think that you stated that where alcohol is used under your first head—namely, as a medium, something like 20 per cent. disappears in the industrial process ?—I think I said that between 10 and 20 per cent. might disappear.

916. I thought you had finally settled on 20 per cent. as the probable figure ?—No.

917. I was going to ask you if you did not regard that figure as being too high as a matter of fact ?—It would be excessive in most cases.

See Q. 801.

918. Would the disappearance be very much the same, for example, where it is used for the extraction and separation of one or more products from one another ?—I should say so, but it might not even be so much as 10 per cent. It would depend upon the temperature, and the conditions under which you are operating.

Dr. A. Rée.
22 Nov. 1904.

919. I suppose that under your fourth head, the use of the alcohol as a solvent for certain products, where the solution so prepared is an article of commerce, it goes out with the substances carrying it ?—Exactly ; if there were a solution of colour or solution of a perfume it would go out with it. *See* Q. 820–1.

920. And there is no recovery there at all ?—There is no recovery at all.

921. I am going to put a question to you that you may not be prepared to answer—if so, please say so : Had you any particular product in your mind when you said that something like 10 to 20 per cent. of the alcohol disappeared when alcohol was used as a medium ?—Yes, I had the product in my mind with which we have had experience. The product, the final colour, had to be filtered off from the alcoholic solution under conditions in which it was impossible to avoid a pretty considerable loss of alcohol. If I remember rightly, a comparatively warm alcohol would be used, and the filtration would take place while the solution was comparatively warm ; therefore, we could not possibly avoid a certain loss.

922–31. I will not ask you what the name of the substance is, because if I ask you and you were to tell me, I probably should not be much the wiser ; I will ask you what is the prime cost, we will say per pound, of the substance you have got in this way ?—It would be about 3s. or 4s. a pound.

932. Now, can you give us an idea how much alcohol is necessary to produce this pound of colouring matter ?—How much alcohol would be lost ?

933. No, not lost ?—How much is used in the production of one pound of colouring matter ?

934. Yes ?—I am not prepared to give you those figures—I do not know them ; otherwise I should be quite pleased to give them. First of all, I should mention that although I am a chemist, I am the one who deals more with the commercial aspect of questions, and my partner is the one who deals more with the industrial aspect of them.

935. Then, you would not like to say how much alcohol disappears in the production of a pound of this stuff ?—I would not, but I think I should not be wrong in saying that 10 to 20 per cent. of the total quantity of alcohol used would disappear.

936. I should like to know what that total quantity is. I wanted really to see what the relationship was, in fact, what part the alcohol played as a factor in the cost of production, but you are not prepared to give me that ?—Might I mention that even though it be only a small factor, competition in these products is so great now-a-days that even small factors count and a matter of 5 or 10 per cent. in the final cost of the product would be one very material importance.

937. (*Mr. Tyrer.*) Have you seen that Table ? (*Handing copy of the Journal of the Society of Chemical Industry to the Witness.*) Are there in that list any of the products you make, and would those figures give Dr. Somerville any idea of the ratio which he is trying to obtain ?—I see here the colour I am referring to. The percentage of ethyl alcohol is not named at all, and the price per pound is incorrect, and the estimated annual imports is also totally incorrect. *See also* Q. 108.

938. Might I suggest to you, as we have suggested to previous witnesses, that you should take that Table, which is in my opinion a very important piece of evidence, and criticise it ?—So far as I am able to do so, I will.

Dr. William Reginald Ormandy, called ; and Examined.

939. (*Chairman.*) You are chemist to Messrs. Crosfield & Sons, Limited, of Warrington, I understand ?—Yes.

940. You have the degree of Doctor of Science of Tübingen ?—Yes.

941. And you are now Fellow of Owens College, Manchester ?—Yes.

942. I believe Messrs. Crosfield & Sons are large soap manufacturers ?—They are manufacturers of soap and chemicals.

Dr. W. R. Ormandy.

943. Is soap their principal product ?—No, heavy chemicals I should say is a greater branch now than soap making—that is caustic soda, silicate of soda, and so on.

Dr. W. R. Ormandy.

22 Nov. 1904.

944. So far as the subject matter of our Inquiry is concerned it is the soap manufacture that interests us, is it not?—Yes.

945. It is only that part of their manufacture in which they are interested in the supply of duty-free alcohol?—That is the chief part.

946. Do they in their soap factory use very large quantities of alcohol?—We are also scent manufacturers, and in so far as it is requisite in the manufacture of scents we use considerable quantities of alcohol.

Scents. (*See* Q. 960–5.)

947. Are those synthetic scents that you refer to?—We buy a large amount of synthetic scents, and we simply mix them in the ordinary way of perfumers.

948. Do you mean that having got your synthetic scent you send it out in an alcoholic solution?—Yes. These scents are bought in a concentrated state, and have to be considerably diluted with, of course, absolutely pure alcohol in that case—owing to the scent.

Soap. Advantages of alcohol in making non-transparent toilet soap.

949. Going back to the soap for a minute, the alcohol is used mainly in connection with the transparent soap, is it not?—At the present time, yes, but not of necessity. It would be an advantage to use alcohol in the manufacture of ordinary toilet soaps, because it has certain influences on the physical nature of the soap which tend to make it a superior article.

950. Would you explain to the Committee what exactly the operation of the alcohol would be in connection with those soaps?—Yes. At the present time, in order that we may not have to use alcohol, we use the scents, that is the synthetic perfumes, in a more concentrated form than we care to do, because otherwise we should have to pay for the alcohol at a high price, and it would then be evaporated and lost during the process of manufacture. By putting scents in in this concentrated form it is more difficult to get them evenly distributed in order to make a homogeneous product. The presence of the alcohol, which would enable us to distribute the scent through the mass more easily, would also have the effect of helping to break down the crystalline structure of dried soap, which would tend to the production of a finished article which was more transparent, harder, and more durable in use. To produce that same effect so far as is possible without using alcohol, it is necessary to what is called "mill" the soap to a considerably greater extent than would be necessary if the alcohol could be used.

(1) More even distribution of scent.

(2) Improves texture of the soap.

951. If you used alcohol for that purpose would you use a large quantity or a comparatively small quantity?—It would be a comparatively small quantity per unit of soap made, but it would amount to a considerable quantity on the whole. The quantity would be sufficiently large to make it worth our while to have an officer residing on the premises. I think we were the first firm after the passing of the Act of 1902 to apply for permission to have an Excise officer on the premises who should be in a position to observe the way in which alcohol was used in mixing in with scents into the soap.

952. Did you form any idea in your own mind of what that would cost you if we charged the cost of the Excise officer?—No, I have not got that figure. I have not been with Crosfields very long, and this occurred before I went to them.

953. I do not know that it is material?—All that I can say is that the quantity must be sufficiently large to make is worth our while paying for one or two Excise officers since the attempt was made to obtain this concession.

954. Supposing an Excise officer were to cost you £250 a year; in order to make it worth your while to pay that you must use a very large quantity of alcohol?—Yes, and we do use large quantities. We should use more, of course, if we could only use it for this purpose.

955. Do you know whether as a matter of fact in France, for instance, where I suppose they produce some of the most delicate toilet soaps, they use spirit in the manufacture?—Yes, they use certain scents which cannot be used in the concentrated state, which can only be used in solution, which we may say are practically put out of our reach in this country. We do not look upon them as existing for our purposes as manufacturers of scents for soaps. They are mostly synthetic perfumes of slight solubility, with long chemical names; I did not make any particular note of them, but that is something which I could also obtain and let you know, if desired.

(3) Makes it possible to employ certain scents otherwise not usable.

956. Assuming that you were to use pure alcohol for this purpose, do you think that the constant attendance of an excise officer would be necessary?—It would be impossible to denature that alcohol with anything which would leave it suitable for our purpose which had the slightest scent. It would have to be something in the nature of a resin. That was proposed and was objected to, I believe. If any scent were used it might leave the material right for the manufacturer of some scents, but would spoil it for others. The method that was proposed was that the absolute alcohol, or the pure alcohol, should be in a sealed vessel. Perhaps I had better describe very shortly the method in which the thing is done. The soap is cut into very fine shavings and dried. Those dried shavings are put into a hemispherical pan, and a lid is placed over those in the centre of which is a number of knives which run at a high speed and cut the shavings of soap into very fine fragments. Into that hemispherical vessel scent is passed to be intimately mixed with the soap. It was proposed that the absolute alcohol should be kept in a sealed vessel in what is now known as the Excise room, should be measured out there by the Excise officer, and placed by himself in this vessel to be stirred up with the soap. I believe the notice was sent on the very day or the day after the Act passed. We had tried for it before the Finance Act of 1902, and the notice was sent up immediately after, I think, but it did not meet with approval.

Extent of Excise supervision necessary with pure duty-free alcohol.

957. Do you remember whether it was clearly explained that what you wanted to use alcohol for was not merely for producing transparency in the soap? So far as these questions of the use of alcohol in the manufacture of soap is concerned, we have always regarded it that the alcohol was required in order to produce transparent soap, and I do not recall that anybody has put before us what you are now putting before us, namely, that the alcohol is desirable for other purposes besides. The difficulty as regards the use of duty-free alcohol for transparent soap was that there is a duty of 3d. per lb. on imported transparent soap, which is intended to counterbalance the cost to the manufacturer in this country of using duty-paid pure alcohol. Therefore we felt that as long as that duty remained it was difficult for us to apply the Act of 1902 to making in this country the corresponding article to that upon which the import duty was charged of 3d. As I say, I do not recall that it has ever been very clearly brought before us that it was desired to use alcohol for the purposes of other soaps besides transparent soaps?—It undoubtedly reduces the cost of the manufacture by distributing the scent more rapidly; it undoubtedly improves the texture, and it also enables scents to be used which at the present time are practically out of the field. The fact also that in neutral markets, in the east particularly, the English toilet soap manufacturers cannot compete—chiefly I think with German competitors—was brought before my notice. In neutral markets England practically can get a fair share of the trade in what we might call industrial soaps—bar soaps and the like—but when it comes to toilet soaps, especially the highly scented toilet soaps which have to be sent into the east, England sends a very small proportion I am told.

Finance Act, 1902, s. 8. Difficulties in way of application to transparent soap.

German competition in toilet soaps.

958. In regard to those highly scented soaps, would not the high scent overcome the smell of the methyl in the methylated spirit?—I do not think so, but that is a question which I am not in a position to answer. As a matter of fact I have very little to do with the soap side; I am there doing research work in other directions entirely. I could not say, therefore, but it is a strong and sticking sort of smell.

959. Messrs. Crosfield do make transparent soaps, I presume, and do for that purpose use the methylated spirit?—No, we do not make transparent soaps.

960 (*Dr. Thorpe.*) Then you do not use methylated spirit?—We do use methylated spirit in the works—I am afraid I do not know what it is used for, but it is in comparatively small quantities. We buy barrels at a time of methylated spirit, but it is bought in nothing like the quantities of the absolute alcohol which we buy. The absolute alcohol is practically entirely used for the manufacture of scents, for which of course it is well able to pay a duty, and as to which there is no question whaetver of appealing.

Use of pure alcohol in making scents. Duty no hardship.

961. (*Mr. Nicholson.*) The price of scents being so high that you can afford to pay the duty?—They are distinctly an article of luxury, and are in a position to pay the duty.

962. (*Mr. Tyrer.*) I take it you are speaking now of the perfumes, and of perfumes alone ?—I am speaking of the perfumes used as perfumes and sold in bottles.

963. In other words, along with your ornamental toilet soap business you have a perfume business which is distinct from your toilet soap business ?—Quite.

964. (*Chairman.*) There of course people are willing to pay the price that you have to demand on account of the duty-paid alcohol for these perfumes ?—Yes.

965. And you expect to get the duty back ?—That is so. There is no question about it in regard to scent. There is no cause for complaint.

Synthetic perfumes. Their importance in soap making.

966. But as I understand you do not yourselves make the synthetic perfumes ?—No. The use of alcohol in the manufacture of synthetic perfumes was a point I was asked to make a note about.

967. There the question of alcohol becomes important ?—Very important. Crosfield's have gone on the lines, as far as possible, of making everything which they require themselves so far as it pays to do it. They make, for instance, their own silicate of soda and their own caustic soda, and they make it in large quantities, in order to reduce the price and to sell on the open market. They looked up the question of manufacturing their own synthetic perfumes, of which we buy very large quantities indeed. When it is borne in mind that a 4d., 6d. or a 1s. tablet of soap does not contain more than a halfpenny worth of soap itself—entirely independent of the scent—and that the value of the scent may be anything from twice up to twelve times or more the value of the soap, the question of being able to make the synthetic perfumes on the works becomes a very serious one. Our bill for perfumes is very much larger than our bill for soap manufacturing as far as regards toilet soaps and the higher grades of which I am speaking—such things as the erasmic soap.

Necessity for importation under present conditions.

968. Are the synthetic perfumes that you use and those that you purchase all imported ?—Practically they all come from Germany, France and Switzerland. Heine and Schimmel, of Germany, are great purveyors and great makers of those.

969. As a matter of fact are synthetic perfumes made at all in this country now do you know ?—So far as I am aware they are not. I do know this that we do not purchase any made in this country.

970. Let us assume that Messrs. Crosfield wished to make their own synthetic perfumes and for that purpose it was absolutely necessary for them to use pure alcohol in connecton with that branch of the manufacture; do you think there would be much difficulty in devising arrangements which would effectually protect the revenue against any misuse of the spirit ?—It would be necessary to run that part of the works entirely separate from any other part—to make it as a separate building—and I think it would be necessary to run it under Excise control.

Continuous Excise supervision would be necessary under Finance Act. 1902. (*See* also Qs. 1115 to 1124.)

971. In the continuous presence of an Excise officer ?—I am afraid so.

But advantages probably worth the expense.

972. Is it conceivable that the saving which it would make to Messrs. Crosfield, would be sufficient to cover the expense of continuous supervision ?—From the inquiries which were made some time ago when the firm thought of taking this up, I should say that it would. They went into the question and they sent people over to Germany to go into the whole matter. They found that alcohol was wanted in such large quantities, that until there was some chance of getting what one might call friendly co-operation on the part of the Excise people, it was quite impossible to dream of making them here. The matter, therefore, was not gone into with the fulness that it might have been; but Dr. Markel, the managing director, tells me that it is his desire and his ambition to make the works, as far as possible, self-contained, and to take up the manufacture of these perfumes if it can be done. I have no doubt whatever that he would go into the matter very keenly at once if there is the slightest chance of such co-operation.

973. Is there reason to think that at present the producers of synthetic perfumes have a very wide margin of profit on their product ?—Yes, I should think there is.

974. So that if it was open to a firm in this country to produce the perfumes, there would be a very considerable margin between the cost of production to them and the cost which they have to pay now ?—Such must have been the conclusion they came to, otherwise the firm would not have been so anxious to take the matter up, I take it. Then one must bear in mind also, that probably there is more perfume used in England than in any other country. The home consumption is a very large one.

975. Do you know exactly how the alcohol functions in the production of synthetic perfumes ?—I am afraid I know very little about it, and I could not answer that question with sufficient accuracy to make it advisable to offer an opinion.

Competition in British market of foreign soap made with cheaper perfumes and containing no spirit, *i.e.*, not liable to Customs Duty.

976. You refer in your *précis* to the foreign competition in the toilet soap trade at home and in neutral markets; is the competition in the home market severe ?—About 25 per cent. of the milled soaps used in England probably come from abroad.

977. That is because it is a very cheap, but also a very bad soap, is it not ?—It is not a question of the value of the soap. What they could save out of the value of the soap would not matter very much, as there is not a very great difference in that. The difference lies chiefly in the value of the scents.

978. (*Dr. Thorpe.*) In the manufacture of those very low-grade soaps, the very cheapest kind of soap that you are referring to here, alcohol does not function to a very considerable extent, does it ?—No, not to a considerable extent; but still it is quite sufficient when it comes to a difference in margins of profits.

979. We cannot get 3d. per pound at the Customs on that character of soap; we cannot get any duty on such soap ?—It would be an exceedingly difficult thing to put a duty on it, because one manufacturer might make a certain soap and say that he had used strong perfumes and used no alcohol at all, and another manufacturer might use alcoholic extracts in order to make that same soap.

980. You are, of course, aware that if we catch the minutest trace of alcohol in this soap, we act, and it is not a question of quantity ?—There is none left in.

981. Of course, if there is none put in ?—It does not follow that because you cannot find it in the soap, it has not been put in.

982. If it has been put in, it has only been put in to the very smallest extent, otherwise, we should find traces of it. As you know, alcohol clings to the soap for a very long time ?—I know it is very difficult to get it out, but during the milling process it has an excellent opportunity to get away, because the soap is spread in such thin films and is exposed to the air.

983. If we get the least re-action for alcohol in these imported soaps, we at once put the duty on it—if we can detect the minutest trace of the alcohol ?—I know that is so.

984. (*Chairman.*) What I rather meant to suggest was this, that those very cheap soaps that are to be found in the home market are there because of their cheapness and inferior quality; but, as a matter of fact, probably Messrs. Crosfield & Sons would not care to make such an inferior quality of soap at all ?—I hardly think that that meets the case, because there are certain foreign markets, such as China, where the price which will be paid for a soap is so low that very inferior soaps have to be supplied. The chief difficulty is to know how to make the stuff stick together, the fats are down to 13 per cent., whereas a good soap may have 85 per cent. of fats. Yet those soaps are exported in enormous quantities.

985. From this country ?—Yes. Messrs. Gossage probably export the largest quantity, and Messrs. Crosfield the second largest, but I think Messrs. Gossage have the largest export trade in low-grade soaps to the East, and, in fact, I may mention they have been celebrated for their low-grade soaps for many years.

986. (*Mr. Tyrer.*) Do you make transparent soaps ?—Our nearest approach to transparent soaps are made without alcohol. Some we make at the works are not really transparent soaps in the sense that Pears' soaps are transparent, but they have the same brownish colour.

987. (*Chairman.*) Those transparent or quasi-transparent soaps that are made without alcohol are apt to have very injurious qualities, are they not ? We were

Dr. W. R. Ormandy.
22 Nov. 1904.

told the other day that they would injure the skin, and that they are very burning and caustic?—That I cannot say. The necessity for free caustic is certainly not there. I know the test which is applied to toilet soaps at the works is such that anything containing ·05 per cent. of free alkali, caustic alkali, would be immediately rejected as an absolute impossibility.

See Q. 951.

988. You refer next in your *précis* to "the efforts made to suit the excise officials, and the futility of them;" what does that relate to?—I was referring there to what I have just been telling you happened previous to 1902.

Alcohol for purification of edible fats.

989. Then you refer to the processes for the manufacture of edible fats which cannot be used in this country; will you tell the Committee something more about that subject?—Some few years ago the firm used exceedingly large quantities of cocoa-nut oil, and finding out that a purified cocoanut oil was being sold in Germany for edible purposes, desired to take up the manufacture of this article from the German inventors. A certain amount of correspondence passed; the people refused to say what the process was until certain preliminary negotiations had been gone through, and then these having been settled they described the process shortly. It necessitated the use of absolute alcohol. I think that came at a period when the firm had been trying to get certain concessions with regard to the use of alcohol; and they immediately said: No, if it requires alcohol we shall not bother with it at all. They refused to take it up, and the matter was dropped, although the man was in a position to prove that very large quantities of this had been and were being made by this procees, and sold and used in Germany. Some time afterwards another process came out for the same substance which did not necessitate the use of alcohol; and there has been a good deal in the papers lately about the progress that has been made in Germany and in France with regard to the manufacture of this article. Crosfields have taken it up, and will shortly be putting it in large quantities on the market. But had it not been for the discovery of another process, whereby the same end could be achieved without using alcohol, they would not have looked into it, although they were in a position, owing to their being such large buyers of cocoa-nut oil, to carry out this operation.

990. Do I understand that now, owing to this new process, alcohol is not required?—Not in that particular manufacture; but it might with advantage be used.

991. Can you tell us anything about other edible fats?—No. That is the only one case I have. I thought it well to mention that as a case which had cropped up. I think this manufacture is essentially a valuable one, because it enables a fat which is not only easily digestible, but which is absolutely freed from all possible taint, and is absolutely incapable of going bad under a period of from two to three months, and which is a valuable food, to be given to the public at an exceedingly low price compared with animal fats.

992. We have had some evidence on this subject, in the course of which it came out that there is at the present moment a manufactory in London which extracts the cocoa butter, and in the course of the manufacture uses the alcohol in the form of methylated spirit. What should you say on that subject?—The people who communicated with us and wished us to take up this process would neither recommend or guarantee the use of methylated spirits; they would have nothing to do with it unless we could use absolute alcohol. I take it that they had used absolute alcohol only, and were not going to take an unknown risk upon their shoulders.

993. Is that your own opinion, too, as regards the use of methylated spirits for such a purpose as that?—I should not like to say. I do not know enough about the nature of the material which is used for denaturing to say whether it would leave any of those obnoxious smelling materials dissolved in the fat which would be more difficult to remove than the alcohol itself

994. You have not given your own personal attention to that particular subject?—No; because they had put up the plant for manufacturing it otherwise than by the use of alcohol before I went to the works.

995. With reference to the subject of the edible fats, are you aware whether abroad there are other edible fats than this cocoa butter which are being treated by alcohol?—There are edible fats made both from cocoanut oil and from cotton seed oil.

Fats treated with alcohol abroad. Used for butter substitutes, etc.

996. Treating of edible fats, is the fat as purified with the alcohol subsequently used as an ingredient in some compounds?—No. The crude cocoanut oil contains albuminous matters which will permit of fermentative organisms growing and making the fat rancid; and it also contains a certain amount of free fatty acids. It is the free fatty acids and the albuminous materials which must be removed, the neutral oil being left. The difficulty is the removal of these things and the leaving of a sterile neutral oil behind.

997. When you have produced that particular product, what exactly are the applications of it?—Very large quantities of it are sold to the confectionery businesses. The fat which is produced is absolutely free from water, which is an advantage compared with butter, for instance, for confectionery purposes. It acts exceedingly well, and very large quantities of it are used because it is cheaper than even a cheap grade of animal fat. Then, again, it is mixed in certain ways with water for other uses. In Germany, I should say that the material is used by the people as butter and in the place of butter. It is sometimes mixed with butter and sometimes used by itself, even in its hard state. It is crushed and warmed, and the German housewife manages to make it take the place of butter. In this country they could not make it take the place of butter. We tried it. We sent it out, and the housewife put it into a frying pan and got it hot, because there was no water in it it did not frizzle, so she kept getting it hotter and hotter, in the hope that it would frizzle, and she was not satisfied till she got a blue smoke coming off, and in consequence everything that was put into it was charred immediately. In order to make it suitable for—I am afraid I must say it—the lower intellect of the English housewife, it was necessary to put water into it in order that it should frizzle, and the putting of water in and keeping it there has proved a very serious difficulty, which has, I think, now been overcome.

998. Might those particular fats used in combination with animal fats produce a fairly good substitute for butter, like margarine?—Its largest sale is to the higher grade margarine makers, who buy this material and mix it with a certain amount of animal fat. Sometimes I have a sort of idea that they do not mix it with anything at all, but that they sell it as it is.

999. (*Dr. Thorpe.*) Sometimes they mix it with butter?—Yes.

1000. Could you tell us whether there is an importation of these fats from abroad into this country on any large scale?—That I cannot tell you.

Alcohol as a source of light and heat.

1001. Now I come to your last heading, namely, alcohol as a source of light and heat. Would you tell us first what advantages you consider alcohol may have from those points of view?—The facts that by means of alcohol it is possible to have table lamps with the incandescent light is one advantage. At the present time the incandescent light is only possible practically with gas, although I know that paraffin lamps have been made for an incandescent mantle.

Incandescent lamps.

1002. (*Mr. Scott-Montagu.*) Is it the Welsbach Era lamp that you are referring to?—I am not sure, but I think it may be the Era. I do know this, that I came up to London on purpose to see it, having had an advertisement from the people stating that they were on show. I went to a place in Victoria Street, and when I got there I found that the address they gave was occupied by a flower shop. I did not know whether I was to take it that it had been a commercial failure, but they had gone and left no address. There is no question about it that the paraffin incandescent lamp has very many disadvantages. It has, of course, all the advantages which the use of paraffin brings with it, but there is a great difficulty in converting paraffin into a gas in such a way that it will burn with a colourless flame so that mantles can be used. From its very nature it is obvious that practically it is a difficult operation to convert it into gas without charring and without depositing carbon; so practically it has a great many disadvantages, whereas alcohol only requires slight heating to convert it into gas. The second advantage in the use of alcohol is from the fire point of view; and this applies more particularly to alcohol spirit as a source of power, especially for sub-

Advantages of alcohol over paraffin:
(1) Easier conversion into gas.
(2) Less danger of fire.

marine work, where petrol for instance is used at the present time. It can very easily be extinguished by admixture with water, whereas paraffin and petrol when once burning fiercely are more easily extinguished by the aid of sand, or something which will suffocate them. Then, again, to produce a given amount of light by means of alcohol used in a lamp, we know that with an incandescent mantle it is only necessary to consume about a third the amount of air which is necessary to produce the same amount of light with the ordinary type of paraffin lamp with the circular or the duplex burner, which from a hygiene point of view is a distinct advantage. Then again it is not easy to get a lamp which will give you twenty, forty or sixty candle-power in the shape of a paraffin lamp which will not be unduly heavy or unduly large; whereas it is easy to get an alcohol lamp which will be quite a light portable lamp and will give from forty to sixty candle power, at the same time not being unduly liable to get out of order. Again, the consumption of fuel in such lamps has been reduced to a very low point, to such an extent indeed, that alcohol at 1s. 3d. per gallon can compete per unit of light with paraffin at about 8d. per gallon.

(3) Smaller air consumption.

(4) Makes a light portable lamp possible.

(5) Economy in consumption of fuel.

1003. (*Mr. Nicholson.*) You are speaking of the strong gallon, I presume?—Yes. Alcohol of 95 per cent. strength is the strength which it is found advisable to use in most alcohol lamps in Germany, though, strange to say, one lamp was tested at the *Gährungs Versuchsanstallt* which gave a higher rate for the same consumption when working with 10 per cent. of water than when working with 5 per cent. of water. That peculiarity was found not to be a mere feature of the mixture, because it continued during a trial which lasted over a thousand working hours.

1004. (*Chairman.*) Taking alcohol for lighting purposes, there is no particular necessity for its being quite pure, is there?—No; it is simply the question of price.

1005. The methylated spirit as now sold, which we use for our tea pots and coffee pots would do perfectly well, would it not?—That again is a point which I could not answer completely. So far as I am aware no experiments have been carried out as to the influence of a large amount of the denaturant which is used in England on the behaviour of these lamps over a contiuous and long period. It is known, for instance, that an addition of 2½ per cent. or a mixture of three parts of crude methyl alcohol and one part of pyridine bases in alcohol containing 10 per cent. of water exerts a deleterious effect on the wick of such lamps in a comparatively short period of time; whereas with alcohol containing only 5 per cent. of water the influence of the denaturant is not as great. It is the presence of water conjointly with that of the denaturant which seems to render the denaturant more dangerous. Experiments are in hand at the present time to find out whether it is the pyridine bases to which the fault is to be traced or whether it is the methyl alcohol. The last report I had was that the tendency seemed to point to the fact that it is the pyridine bases, and that the methyl alcohol itself was not so deleterious. That seems to point to the fact that the present denaturant would not be deleterious. But one must bear in mind that the methyl alcohol has not so great a calorific value as the ethyl alcohol, and consequently with such a large amount as 10 per cent. added it would probably not be possible to work with as large an amount of water in the alcohol as it is possible in Germany with the addition of a mere 2½ per cent.

Methylated spirit for light and heat. (*See* also Q. 1046–52 and 1067-8.)

1006. (*Dr. Thorpe.*) Methyl alcohol has a much higher calorific power than water, has it not?—Yes.

1007. If you add 10 per cent. of water, and yet get the desirable result that you say, surely you can replace a certain quantity of that water with methyl alcohol?—You would not be able to have 10 per cent. of water in a mixture of ethyl and methyl alcohol. It was in that direction that I was pointing. It is very much cheaper to produce an alcohol containing 10 per cent. of water than one containing 5 per cent.; it is not a mere percentage difference—the cost of production is considerably greater.

1008. My point there was in reference to the calorific values of the two kinds of things. You said that one objection against the use of methyl alcohol was that it had not the same calorific value?—That it has not the same calorific value as ethyl alcohol, and consequently that you could not add as much water to a mixture of the two as you could to one alone.

1009. Possibly not, but then of course in the case of water the calorific value is a negative amount; there is no calorific value at all?—That is so.

1010. On the contrary it absorbs heat?—Now we are going into very debatable points. It is by no means settled that the presence of water in alcohol under those conditions does not produce a positive beneficial result, exactly as it does in motors in which you can get a better result from absolute alcohol mixed with some water than you can get from absolute alcohol without water. There are other effects.

1011. But my question assumed that you were determining the calorific value of the thing alone, and not as doing work in, say, a motor?—I quite see your point, and I quite agree.

1012. You cannot get over it, can you?—No.

1013. (*Chairman.*) The point that we started from was this: that at the present moment you are not in a position to assert that pure alcohol is necessary for this purpose?—I do not wish to assert that pure alcohol is necessary for this purpose.

1014. Indeed you could not even go so far as to say that it was preferable?—No. It is certainly here a question of cost. I think that with the present 10 per cent. of methyl alcohol the evidence seems to go in the direction of showing that it would not be deleterious for lamp purposes, though it might cause you to use a stronger alcohol than you otherwise would do—and that means a more expensive alcohol.

Cheapness, not purity, the essential thing.

1015. Do you know what attitude the fire insurance companies take with regard to spirit lamps; do they regard them as more or as less dangerous than petroleum lamps?—That is a point which I cannot answer; it is one which I have not looked into.

1016. So far as I know, spirit lamps are not very largely used in this country?—No, and I do not think an insurance company in this country would give you an opinion, because they have got nothing to go upon.

1017. Are the spirit lamps now being used very largely in Germany?—It would be impossible to say how many exist; there are about seventy or eighty million litres of alcohol per annum used, for the greater part in these lamps.

Extent of use for lamps in Germany.

1018. In Germany?—Yes; and one company alone are selling incandescent lamps at the rate of 100,000 per annum.

1019. (*Mr. Tyrer.*) And they are so busy that they cannot supply any to this country?—Is that so? That may account for the fact that I have written and asked them to send me two or three of their lamps, and some of the flat-iron things that they make, and they have not taken the trouble to acknowledge the letter yet.

1020. (*Chairman.*) Are they a comparatively modern introduction into Germany?—Practically they have been made into a serviceable article within the last five years.

1021. (*Mr. Tyrer.*) With regard to the insurance point, it is interesting to know that since I read my paper at the Society of Arts, in which I quoted your paper read before the Automobile Club, and was favoured with similar lamps which were at Sandringham for exhibition, some of the insurance people have called on me, and others have made appointments for me to call upon them, and I have very much disarmed—what shall I say—their fears?—There was a danger with the lamps as first brought out. Many of the varieties of lamps used in Germany at first had a small secondary light at the bottom, which was kept burning continuously and was used to vapourise the bulk of the alcohol which formed the colourless flame higher up. Those lamps were recognised as more or less dangerous. They produced such a great heat in the head of the lamp that it was not allowed by law to use such heads on glass containers. In the last three years the whole tendency has been to make the lamps in such form that inside the flame there is a solid mass of copper with conducting pieces going down along with the wick, and the heat carried down these is sufficient to vapourise the alcohol going up. These do not produce such a heat in the head; in fact it is quite possible with those to use the burners on an ordinary glass or porcelain container.

Question of Insurance.

1022. Can you tell the Committee what the requirements in Germany are as regards the denaturing of the spirit

German denaturant for spirit

Dr. W. R. Ormandy.

22 Nov. 1904.

used in lamps. (*See* Appendix No. III.)

used in these lamps?—Yes. The alcohol is sold in sealed vessels as a rule now—in bottles like our soda water or ginger beer, with a screw stopper, and they must have a label attached, or must be sold in a shop where a ticket is hung up so that the public can see it, stating that the contents are either 95 per cent. of alcohol or 90 per cent. of alcohol. They are sold at certain fixed prices. They are bound to contain 2½ per cent. by volume of a mixture consisting of three parts of crude methyl alcohol, which must pass certain Government tests, and one part of pyridine bases, which must also pass certain Government tests, which mixture is supplied to the denaturers by certain large firms of chemical manufacturers who are appointed as agents for the sale of this material by the Government—people like Kahlbaum and Merck.

1023. Then the denaturing of alcohol for this purpose is confined to certain approved persons, and is not open to any person to undertake?—Yes. As a matter of fact the greater part of it is denatured by the *Verein für Spiritus Verwerthung*, who are the people who control 98 per cent. of the total output.

1024. (*Dr. Thorpe*). Are you speaking of a recent enactment as to the denaturing? Are you aware that within a comparatively recent time the regulations have been altered as to the denaturing of this particular spirit?—Do you mean within the last twelve months?

1025. Yes, or about that time. Of course you wish to be accurately reported. This matter has been under revision by the authorities on the ground of the increasing scarcity of the pyridine bases?—Exactly it may be under revision, but I am not aware that any enactment has been passed with regard to it since the law was made that 2½ per cent. of this mixture was allowed. I know this: that in the official organ, the *Zeitschrift für Spiritus Industrie*, there was a statement which appeared about three months ago that the pyridine bases were becoming dearer, and that Government action would have to be taken.

1026. It has been taken?—It is a most remarkable thing. It certainly has not been taken within the last six months according to the *Zcitschrift für Spiritus Industrie*; and it is only about nine months ago that I was over in Germany. My informant, in regard to these points is Behrend, the statistician for the Government with regard to alcohol.

1027. When you get your proof, perhaps you will look into this point and bring it up to date?—I will. I am glad you have mentioned it. I have stated what the law was when I was in Germany.

1028. (*Mr. Tyrer.*) And it is supposed to be effective?—Yes.

1029. The alteration of the law arises as Dr. Thorpe reminds us, not from the inefficiency of the mixture as a denaturant but from the scarcity of the material?—Yes, the pyridine bases are going up in price.

"Complete" denaturing of lamp spirit required in Germany.

1030. (*Chairman.*) Whatever the precise ingredients are, what is required is, that the spirit should be completely denatured in the sense that it is denatured in the most complete way that the law requires?—Yes. The German Government recognise two forms of what are called complete denaturing agents—I am speaking now of what was the law when I was there about nine months ago—the first being called the *algemeine denaturant*. This general denaturing substance is the mixture I have spoken about of 2½ litres per hectolitre of this mixture of crude methyl alcohol and pyridine bases. They recognise also, as a general denaturant, an addition of 1½ per cent. instead of 2½ per cent. of this same mixture, together with not less than 2 per cent. of benzol, together with an addition of methyl-violet in such quantity that the mixture has a distinct violet colour. I remember working out the actual weight for the Automobile Club, and I think it is one part of methyl-violet to a million parts by weight of the denatured mixture. In France they used malachite green which has a much higher percentage of ash, and which created a good deal of trouble both in lamps and in motors.

Motor spirit denatured with a different mixture, and distinguished by addition of colouring matter.

1031. (*Dr. Thorpe.*) You may explain to the Committee why the addition of the colouring matter is required?—First of all this is alcohol which is not desirable for use in lamps, and the colour is added, I should say, to distinguish it from the generally denatured alcohol which is suitable for lamps. The addition of this small amount of benzine, which burns with a smoky flame, renders it not so suitable for use in lamps as the other; and the colouring matter is introduced to distinguish it from that. Then again, I suppose it is done to enable the motor users to know they have got hold of the right material.

1032. It is also sold at a different price is it not?—It is sold at a different price.

1033. And it is to prevent the substitution of the one for the other to poor people, because the price of the other is fixed by regulation?—Yes, and this is cheaper. As a rule it is sold in bulk. That is the great point. The motor users in Germany who use this alcohol are not automobilists, they are agriculturists, and they buy it in large quantities delivered at the nearest railway station.

1034. (*Mr. Scott-Montagu.*) It is used by motor-cars, too?—Very little I think.

1035. As a matter of fact it is?—I think it is used in comparatively few cases.

1036. Perhaps because there are a very small number of motor-cars in Germany, comparatively speaking?—That is so compared with the number in this country. But you cannot buy this motor alcohol very easily. You can go into a hundred villages in Germany and you cannot buy it.

1037. In the towns they are using it?—Yes, possibly, in the towns they are beginning to use it more.

1038. (*Mr. Tyrer.*) It is being used for agricultural work you say?—Agricultural work is the chief thing that it is used for, and there they have made contracts existing until 1908 with a fixed price from which the alcohol makers are suffering very badly.

Efficiency of German denaturant for lamps.

1039. (*Chairman.*) Taking the general denaturing agent as described by you, namely, two and a half litres of a mixture which consists of four parts of wood naphtha to one part of pyriding bases?—On that point I have been speaking from memory and not from notes, but I thought it was three parts.

1040. I think this was taken from quite a recent volume of the German Regulations?—Possibly, they have made it four to one and that may be the alteration in the law which Dr. Thorpe has spoken of, made in order to reduce the percentage of the pyridine bases which are getting rather expensive.

1041. For my particular purpose at the moment, I would rather take it at four parts. The question I wish to ask you is this: taking a mixture composed of four parts of wood naphtha and one part of pyridine bases, and appplying that in the proportion of 2½ per cent. of the alcohol, would you regard that as a complete protection of the public so that the spirits so denatured might safely be allowed to go about the country?—An answer to that can only be a simple expression of opinion that the fact that this material gets broadcast into the hands of the public in Germany to a degree which would be hardly possible here for a long time to come, and that they spend a lot of money in advertising it, and in causing it to be distributed and stocked in all the little villages, where it gets into the hands of the public in a way which is absolutely unknown here with regard to methylated spirit for instance—all these things do seem to show that it may be safely allowed to go about the country.

1042. Still there is no limitation upon the quantity that people might accumulate in Germany at present?—No.

1043. As a chemist if you had a large quantity of spirit denatured in this German way, do you think that you could profitably eliminate the denaturing agent sufficiently to enable you to make use of the spirit so purified as a commercial article?—I should like to have a barrel of it and a little time in order to carry out experiments. I could not possibly say now.

1044. I want you to come to this now, what may be sufficient in Germany, where you have a margin represented by a duty of 1s. 9d. may not be sufficient in this country where you have a margin represented by a duty of 11s. In the one case if you do purify your spirit the most that you can make of it is 1s. 9d., subject to considerable reductions for the cost of purification; but in the other case you may make 11s., subject, of course, to those reductions?—Yes.

1045. Therefore, what would be profitable in this country, might not be profitable in Germany ?—That is quite true.

Methylated spirit for lighting in this country : its cost the only known obstacle.

1046. Do you tell us that for this particular purpose of use in spirit lamps, our scale of denaturing, which is 10 per cent. of wood naphtha in the methylated spirit used for general purposes, plus a small percentage of petroleum, would not do ?—Might I ask what the small percentage is approximately ?

1047. Three-eighths of 1 per cent. Would that damage the spirit for this particular purpose ?—I do not think that $\frac{3}{8}$ of 1 per cent. of petroleum would affect it for lamp purposes, but that could not be settled except by trial.

1048. (*Mr. Tyrer.*) As a matter of fact it does not ?—I should say it would not.

1049. (*Chairman.*) Then we are at the present moment, in this country, in this position, that there is nothing to prevent people using these spirit lamps as much as they choose, provided they use methylated spirit, and, so far as we know, our methylated spirit as we understand it, the mineralised methylated spirit, would be quite satisfactory —Yes.

1050. Then the only question between the use of a spirit lamp and the use of a paraffin lamp would be the question of price ?—Yes—the cost of the raw material.

1051. You say that 1s. 3d. per gallon for the alcohol would compare with 8d. per gallon for the petroleum—petroleum is very often below 8d., is it not ?—Yes, but 8d. is the price at which you can buy it practically at any greengrocer's shop throughout the kingdom ; and alcohol would have to be 1s. 3d. at the same spot. That includes the cost of distribution.

1052. That is for the same unit of light ?—Yes. Of course, there are many advantages on the side of the alcohol lamp, but the only thing that will force the alcohol lamp before the public is that it will have to start at least on a level footing with regard to the cost before you will be able, I think, to get it widely tried. After that, possibly, its virtues might go far to spread its use.

Alcohol for Motor power. (For Dr. Ormandy's further evidence *See* Qs. 2008–2157.)

1053. As regards alcohol for power purposes, you, I think, have been nominated by the Society of Motor Manufacturers and Traders to represent them before this Committee ?—Yes. The power side is the side of the subject which I have made the greatest study of, but, unfortunately, I have been unable to meet their Committee yet.

1054. Then you are perhaps not quite ready to give evidence on that particular branch of the subject ?—I am ready, but I do not care to act until I have seen them, as there may be points which they may wish me to bring forward. As a matter of fact, to my mind, if there is going to be a large market created for alcohol in this country, it is going to be in the direction of light first, and of power secondly. I think that the reasons why we should prepare the way for the manufacture of cheap alcohol for power purposes lie very much on the surface. In the first place, the Government want something to replace petrol for submarines, and in the second place we have got a big industry growing up in the form of the motor car industry. That is going to employ much larger numbers, I think, in the immediate future than it does now. We spend £2,000,000 a year abroad in buying motors, and every motor that is produced continues to use petrol, and the new ones use petrol on the top of those. America has already reached the stage where she can only fulfil her own demands, and Russia produces practically no petrol. We live at the present moment on what we can get from Sumatra.

1055. (*Mr. Scott-Montagu.*) And Roumania ?—Yes ; but that is a small quantity compared with the quantities that come in from Sumatra, I believe.

Alcohol in Germany. Materials used. (*See* also Q. 1079–80.)

1056. Have you any knowledge of the materials which are used to distil the alcohol from in Germany ?—Yes. That is a question which I have gone into very fully, including the cost of production, and so on, in Germany of the materials used and the relative cost of producing alcohol from those various materials.

1057. I understand that potatoes and beet are chiefly used ?—Practically no beet is used now, but potatoes and molasses are at present used, and I think there is something coming—that is, sawdust.

22 Nov. 1904.

1058. We have been told by Dr. Rée that one ton of wood would produce 30 gallons of alcohol ?—It has produced 240 litres.

1059. (*Chairman.*) One ton ?—That is according to the very latest information which I have this morning received. I saw a notice in a number of the *Chemiker Zeitung* of a few days ago of a letter from Professor Wislicenius correcting certain figures of his which were those figures, I believe, which Mr. Scott-Montagu quoted, which had been attributed to him, that alcohol had been made from wood, and that the yield was about thirty gallons per ton. He had to state that this was a misquotation, and called attention to a paper which was read a few days ago by him before the *Sachsischen Forstverein in Wehlen*, I immediately wired to Germany for this paper, and I received it this morning. On reading it through at breakfast I saw that the yield had been increased to such an extent that it was equal to about 240 litres of 90 per cent. alcohol from a ton of sawdust. The cost was stated to be, at an outside figure, 10 pfennigs per litre, making every allowance for depreciation, interest, and everything else. As a matter of fact, he said it would probably not exceed 8 pfennigs per litre. Eight pfennigs are equal to 1d., so that 10 pfennigs per litre would be 45 pfennigs per gallon, which is just under 6d. for a gallon of 90 per cent. alcohol, which, of course, is a figure miles below anything that can be done in the way of making it from grain,

Wood a source of alcohol in the future.

1060. (*Mr. Scott-Montagu.*) For the sake of argument, and putting perhaps a somewhat hypothetical question to you, supposing that in the future the value of that was 6d. per gallon, that would mean £1 6s. 6d. per ton of wood converted into alcohol, would it not ?—Yes, but the chief cost lies in the plant and labour.

1061. To put it in another way, a ton of wood in future would be a good deal more valuable for heating and lighting purposes than a ton of coal ?—Yes, it would under those circumstances.

1062. Therefore, this means that there will be a gigantic revolution in the method of heating and lighting ?—Yes, it looks like it if the supply will only hold out. One has to remember that this is a question of very great interest, indeed of vital interest, to Germany, where the study and the carrying out of the laws of forestry is carried to a very high degree.

1063. There is no reason why underwood should not be used for this purpose, is there ?—That is exactly what they do use—and refuse.

1064. Every kind of wood that is now used for hurdles because it cannot be used for anything else, could also be converted into alcohol ?—Yes.

1065. And the tops and lops of trees which cannot be used for anything else in many districts because of coal being cheaper and more efficient, it will be possible to use those also as a very valuable basis for making alcohol ?—Yes. I should say that if those figures are correct, in America, where they have large supplies of timber, they will make alcohol from nothing else, and in Norway and Sweden and such places it seems as though it would be feasible to make alcohol in the immediate future at such a price that it will become obviously *the* fuel, and nothing else will be able to compete with it.

1066. I suppose that leads on to the fact that you probably will be able to use leaves, acorns, and all those things ?—Yes, you can use old newspapers. In fact, you will be able to hand over your old "Autocar" and get back so many gallons of alcohol to run you till the next weekly number comes out.

Use of alcohol for light, heat, and power. Suitability of methylated spirit.

1067. To go to a question which has rather immediate importance : Supposing, for the sake of argument, that this Committee were to recommend any relaxation of the law, and were to suggest that alcohol might be used more largely in this country, I understand from you that you hold a very definite and decided opinion that there would be no difficulty in safeguarding the revenue in the majority of trades of which you have a knowledge ?—From the point of view of light and heat and power, do you mean more particularly ?

Dr. W. R. Ormandy.
22 Nov. 1904.

1068. Do you see any difficulty in either using a denaturant or in taking such precautions as would prevent fraud on the revenue?—I think that the Government would admit that the present denaturant as used is amply adequate to protect them. I think that the denaturant as used at present for the majority of purposes—power, light, and heat—those purposes for which the greater bulk is going to be used, would not interfere with the use of the material for those purposes. It is simply a question as to whether alcohol can be produced at a sufficiently low price to enable it to go on the market and still use a large amount of an expensive denaturant.

Petrol cheaper in Germany than England in spite of duty

1069. Of course, where you get alcohol in continental countries those are nearly all countries in which there is a duty on petroleum?—Yes, and strange to say, that duty produces little effect. Whether it is that the continental tradespeople are satisfied with a smaller margin of profit or not, I cannot say; but at a period when petrol, if you went anywhere in England, except right in a city or in large towns, was 1s. 6d.—that was just before the reduction which occurred recently—at that time, although there was a duty of 3d. per gallon on paraffins in Germany, I was quoted 1s. 3d. per gallon in Hamburg.

1070. But Hamburg is a free port?—That does not matter. That was not in bond; that was in an ordinary ironmonger's shop.

Retail price of denatured spirit in Germany.

1071. (*Dr. Thorpe.*) But the same holds true with respect to methylated spirit. The denatured spirit in Germany bears to the initial cost of it a much less ratio than denatured spirit, that is ordinary methylated spirit, does in our shops?—A smaller ratio of what?

1072. Of profit?—I can tell you the exact figure which is allowed to the retailer by the Centrale for retailing spirit. They enter into an agreement that they will not sell methylated denatured alcohol except in the strengths and at the prices fixed by the Centrale. For that they are allowed a profit of 5 pfennigs per litre, which is equal approximately to 22½ pfennigs per gallon sold, 22½ pfennigs being nearly 3d. They are therefore allowed a profit of a little over 2½d. per gallon by the Centrale for retailing it. I think that is a figure which is certainly not exceeded by the average retailer of paraffin oil in this country.

1073. I am talking of methylated spirit, and I am bound to say that the person who retails methylated spirit here is not satisfied with the same margin of profit that the German seller is?—Naturally, for the simple reason that whereas the German seller sells alcohol like the English shopkeeper sells paraffin, in England the retailer sells methylated spirits in the same way that he sells ipecacuanha and aperients. That makes a very big difference.

German spirit laws.

1074. (*Mr. Nicholson.*) You have had a great deal of experience, have you not, in Germany with regard to German laws, and particularly those which have regard to the use of industrial alcohol?—I spent a considerable time in endeavouring to get a clear knowledge of them from the German law books, but I found it was an absolute impossibility as you could not find where you were. It is worse than an English Bradshaw. So I went to Germany and got considerable assistance from Dr. Behrend.

Excise supervision paid for by traders.

1075. Can you tell us who bears the cost of the necessary supervision?—The cost is divided. I can give you exact figures for one year which I got out as an example. The taxes on alcohol are collected in each kingdom by officials of that kingdom, and they are allowed the sum of 15 per cent. of the total amount collected to cover the expenses of such collection and supervision.

1076. That was hardly the question I meant to put to you. I wanted to know whether you could tell us who bears the cost of supervision in the cases where alcohol is used industrially and without the payment of duty.—If the works require supervision the works have to pay for such supervision; but of course since 1902 works which prior to 1902 were allowed to use pure alcohol may not now do so. They have to pay the duty, but they have a much wider range of denaturants allowed them than is customarily granted here.

Use of alcohol encouraged at expense of consumer.

1077. As you say, the German Excise laws are very intricate, as I know, because I have a little experience of them. Speaking generally they may be said to be framed so as to encourage the use of alcohol industrially at the expense of the consumer; is that not so?—It may be said that one portion of the community, that is, those who consume alcohol for drinking purposes are taxed in order to allow alcohol to be sold to the industrial user at a price below the cost of the manufacture.

1078. (*Mr. Tyrer.*) The drinker has to pay for the privileges of the other side?—That is so.

Policy of Agrarian party to promote growth of potatoes. Outline of German spirit taxes and methods of distribution. Two causes tend towards cheap industrial alcohol. (1) the law (2) the operations of the Centrale.

1079. (*Chairman.*) Is that the result of Government action, or is it the result of trade action?—It may be said to result from the power of the Agrarian Party in the German Government. They have had the laws altered and re-altered until now it is only possible to produce alcohol from potatoes. No new distillery for making alcohol from molasses, which is a very much cheaper process than making it from potatoes, can come into existence; because they are subject to all the maximum taxes which any other class of distillery is subject to; and then they have put a sweeping tax of sixteen marks per hectolitre on the top of all that. In other words it has been rendered impossible for any new manufacturer to start making alcohol from anything other than potatoes.

1080. Do they not use the beet-root molasses?—Only such distilleries as are already in existence can make alcohol from molasses, and they are subject to certain refinements in taxation in order to equalise the diminished cost of such manufacture.

1081. (*Mr. Tyrer.*) I think I rather referred to that fact that the Agrarian Party governed the whole situation in my last paper, did I not?—Yes. They do govern it.

1082. (*Mr. Nicholson.*) Then that advantage which the maker of industrial alcohol gets over the maker of spirits for consumption amounts to a very large sum per proof gallon, does it not?—There is no maker of industrial alcohol.

1083. Perhaps I should say the owner of the industrial alcohol?—There is one owner; I mean that the whole of the alcohol of the state may be said to be bought at a fixed price from the makers by the community—or by a company, as it is, with limited powers.

1084. (*Mr. Tyrer.*) By a trust, would you say?—Yes, by a trust. These people sell a certain proportion of this at a cost below that of the manufacture for industrial purposes, and on the alcohol thus sold for industrial purposes they receive from the Government certain moneys representing the return of certain taxes which have been paid upon that alcohol.

1085. (*Mr. Nicholson.*) And that amounts to many pence per proof gallon, I believe?—These figures, I think, may prove of interest—they are very short. The total tax raised in the whole of Germany in 1903-04 was, in found figures, 196 million marks, and there was given back again in the so-called contingent money 37 million marks, leaving thus 159 million marks. Further sums were also paid back to the extent of 22 million marks, being the taxes which had been got on certain amounts of alcohol which were afterwards sold for industrial purposes.

1086. That is to say, the fermenting vat tax?—What are called *Maischraumsteuer* and *Verbrauchsabgabe*. Therefore taking away the 15 per cent. for the cost of supervision and the cost of collecting the taxes, you start with the sum of 196 million marks, and ultimately there remains for the Treasury the sum of 113 million marks.

1087. To take the case of an individual agricultural distiller, if it is possible to do so, who is faced with that taxation, it may amount to even such a sum as 10d. per proof gallon?—One moment, please, because I cannot think in proof gallons. Suppose that a distiller is only making that quantity of alcohol which is assigned to him by the Government, known as the contingent; we will suppose that he makes just his contingent and no excess. Suppose also that the cost of manufacture of alcohol per 100 litres, for his raw material, his wages, his coal bill, and his own expenses is a sum of 40 marks (or 40s.), that 40 marks including 13 marks for the tax which he has had to pay as a fermenting vat tax—he has had no distiller's tax to pay because he is on a small scale.

1088. The 13 marks, or 13s., he will get back?—It has cost him 40s. say, including the 13s., and he desires to sell that alcohol. He will sell it to the public at 40 marks, plus 70 marks, which is the

tax that is put upon it the moment it goes into circulation in a form free from a denaturing agent, so that it is fit for human consumption. He has thus sold it for 110s. The Government pay him back 20s., because he is allowed to make a certain amount of alcohol, upon which he is only taxed 50 marks, but he has sold it as though it had paid the full tax of 70 marks. The consequence is that he gets a document which is actually worth 19s 6d. instead of 20s.

1089. That is a Government Bill, in fact ?—Yes; and with that Government bill he can pay those taxes. So that you may say it has cost him 40s. of which he has paid 13s. away in taxes, but the Government pay him 20s. back again.

1090. And if he uses it industrially he will recover those 13 marks as well ?—Yes, he might; but under the present circumstances that is impossible. The whole of the alcohol is sold at a fixed price. This year it is sold at 57s. per 100 litres to the Centrale, and the Centrale collect all these sums of 13s. and 20s.—it goes to diminish the average cost to them.

1091. The distiller is a shareholder in the cartel, and therefore he will receive his proportion of the profit on that ?—That is so. It is generally arranged that the price which is paid, the *Beschlag* price, is sufficiently low to enable the company to make a reasonable profit, which is then divided in the form of a bonus per 100 litres.

1092. Then he will recover in the first instance the 20 marks, and he will also get back, will he not, a portion of the fermenting tax.—I think those figures give you all the figures that you require. They are spread over the total yield. The amount of alcohol made pays taxes altogether amounting to 196 millions marks, the Government pays back 36 millions as contingent money, and they pay back 22 millions as mash-tub and fermenting vat taxes, and another small sum of half a million derived in another direction.

1093. What I was trying to ascertain from you was the amount of the bounty, if I may use that word, which the individual distiller will get ?—It depends entirely upon whether the distiller manufactures his contingent quantity or whether he manufactures more. If he manufactures double the quantity assigned to him, upon which he only pays fifty marks, that is equal to a sum of nine shillings spread over the whole amount. As it is only the excess over the contingent quantity which is used for industrial purposes, since the contingent is fixed on the amount that is drunk, it follows that some works at least—and those must be the works which make the industrial alcohol—must make more than their contingent quantity; and in consequence they do not get what you would call the maximum sum of twenty marks paid back on an amount of alcohol which pays seventy marks duty.

1094. (*Mr. Tyrer.*) In other words, industrial alcohol is not favoured to the same extent as would appear on the surface at first sight ?—No, not quite so much. In the total it is spread over a larger ground.

1095. It is, as Mr. Nicholson says, favoured ?—It is favoured.

1096. But it is not favoured to quite the extent that we were under the impression that it was ?—It is favoured to a certain extent, which we can sum up in money, which is spread over the whole amount; but how it is spread depends entirely on the nature of the distillery.

1097. (*Mr. Nicholson.*) It is favoured to the extent that under certain circumstances alcohol is sold below cost price for industrial purposes ?—That is true; but it does not follow that that amount below cost price at which the alcohol is sold is solely dependent on this money paid back by the Government.

1098. I understand that ?—It is also due to the fact that it is in one lot of hands, and it is in their power to charge the drink consumer a sufficiently high figure to give them a margin wherewith to sell this industrial alcohol at a low price.

1099. (*Mr. Tyrer.*) In other words, to give with one hand what they have taken away with the other ?—Yes, they take it away from one class of the community and pay it back to another.

1100. (*Chairman.*) Then, in fact, there are two causes operating to reduce the price of industrial alcohol, one being the Government law and the other the operations of the Cartel ?—Yes. On the other hand it must be borne in mind that the law as it exists in Germany is an expensive law; I mean the cost amounts to 15 per cent. of the total amount of the final full tax before any deductions are made. Suppose that the distillery buys potatoes at one shilling per hundredweight, they cannot make alcohol at less than about thirty marks, which corresponds to about 30s., without any tax, per hectolitre.

Actual cost of production of spirit not less in Germany than in this country, owing to costly Excise restrictions and expensive raw material (potatoes).

1101. (*Mr. Tyrer.*) That is for twenty-two gallons ?—Yes; but if they were allowed to work with the minimum amount of restriction which would still safeguard the revenue, and were allowed to put up a distillery as large as they liked, and were not bound themselves to grow the whole of the potatoes that they required at the distillery, but could buy them, and could get diseased ones and so on, from the neighbourhood, it would be possible to reduce the price. At a private meeting of the *Gährungs Versuchsanstallt* Professor Wittelshöfer, the head of the technical side, and Herr Echenbrecher, the potato growing expert, were together, and they wrote me, as the result of that meeting, that they considered the cost could be reduced from 30s. or 31s. per hectolitre to 25s. That five shillings out of the thirty shillings is unnecessary cost caused by the restrictions produced by the existing law.

1102. (*Dr. Thorpe.*) That is the whole point: what you have been describing so well is the result of a political movement in Germany, which is not done solely to benefit the industries of Germany, but has for its primary object to fix the agriculturists on the soil ?—It has been to bring into cultivation certain plots of land which are capable of growing potatoes and capable of growing nothing else. This tremendous mass of complicated law is entirely directed with a view to enabling every small farmer to have his own distillery.

1103. (*Chairman.*) Then they do not have a central distillery for a number of farmers ?—No. A man does not get all these various reductions which he is open to unless he grows the whole of the potatoes on his own land, unless he uses the whole amount of the residue from the distillery to feed cattle, and unless he uses the whole of the manure from those cattle to put back on to the land from which he grew the potatoes. Those three things are necessary before he can get those reductions which will enable him to make alcohol at such a price that he can compete.

1104. Your figures seem to show that in spite of all these advantages, if they are advantages (or, at any rate, in spite of all that the German Government has done), with the potato spirit the Germans do not produce alcohol any cheaper than we can produce spirit in this country ?—That is so.

1105. In fact it is not so cheap ?—They do not produce it so cheaply; that is perfectly true.

1106. (*Mr. Nicholson.*) It is distinctly a dear material whether you look at it from the point of view of the cost of corn or any other alcohol producing material ?—Yes.

1107. (*Chairman.*) Was that 30s. per hectolitre for material alone ?—No, that is for wages and everything else.

1108. The spirit would be of what strength—95 per cent. ?—They always calculate by 100 per cent. All Government figures in Germany are reckoned per 100 per cent.

1109. Absolute alcohol, therefore ?—Yes.

1110. (*Dr. Thorpe.*) But it is not absolute alcohol ?—That is so, but the figures are calculated to that.

1111. It is about 95 per cent. alcohol ?—Yes.

1112. (*Mr. Nicholson.*) You cannot hope to compete with an article which is sold below cost price in another country ?—No; but the cost price in this country may be very considerably below the cost price in the other country. In fact, it may possibly be as much below as the Germans sell below their cost price.

1113-4. (*Mr. Tyrer.*) Do you say that deliberately ?—If these figures that I have spoken about with regard to timber are anything like approximately accurate, and if, as I am told, in Germany they can make 100 per cent. alcohol at 25s. per hectolitre, that is 1s. per gallon for

Dr. W. R. Ormandy.
22 Nov. 1904.

90 per cent. alcohol as near as makes no matter—if they can do that from potatoes (and they could do that from potatoes if the conditions were simplified to their greatest possible extent)—and if we can here make alcohol more cheaply from other things, to wit, grain, molasses, and the like; then we could certainly make alcohol below 1s. per gallon in this country. In regard to the yield of alcohol from sawdust, I know that two different firms, working in two entirely different ways, are getting yields of twelve to fourteen litres of 100 per cent. alcohol per hundredweight of air-dried wood. If you call it twelve litres that is 240 litres per ton.

Alcohol for synthetic perfumes. (*See* Q. 966, etc.)

1115. (*Dr. Thorpe.*) I gather from your evidence, speaking in your capacity as the chemist to Messrs. Crosfield & Sons, that immediately what you desire to have is the opportunity of using alcohol for the manufacture of the somewhat expensive synthetic perfumes which you want; that is the kind of thing to which you attach great importance?—Yes, that is so.

1116. More so, in fact, than anything else you have spoken of, I think?—That, and being able to use the alcohol for distributing the scent throughout the soap and so improving the texture of the soap.

Small and specially trained staff required for their manufacture.

1117. I want now to ask you a few questions about the manufacture of those synthetic perfumes. Those things are all organic preparations which in their manufacture require a considerable amount of technical skill?—Yes.

1118. I mean to say you would have to put upon their manufacture a rather better class of skilled or trained persons—not ordinary workmen?—It would have to be carried out by what I might call a trained staff consisting largely of chemists, of various grades, of course.

1119 They would not be the ordinary artisans except to the extent that these people might just now and again assist?—Yes, in carrying, and lifting, and moving.

1120. I understand that these scents are really made by the ounce or by the pound, is that so?—Yes, they are made on a comparatively speaking small scale.

1121. And there would be a comparatively small staff of people engaged upon them?—Quite a small staff.

1122. And the work could be done in a room of comparatively small size?—Yes, it would be done in an isolated building, and probably it would be carried out in an undivided room.

1123. (*Mr. Tyrer.*) Practically in a bonded workroom?—Yes.

1124. That, of course, would very greatly facilitate the position of the revenue with respect to it; I mean to say the number of persons engaged would be relatively very small, and they would be of a rather superior station in life?—That is so. For the great bulk of these synthetic perfumes quite a common price is 16s. per ounce. You can get a lot of value into a bottle the size of an ink bottle.

FOURTH DAY.

Wednesday, 23rd November, 1904.

PRESENT:

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair*).

The Hon. J. SCOTT-MONTAGU, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. W. SOMERVILLE.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*).

Dr. WILLIAM HENRY PERKIN, F.R.S., etc., called; and Examined.

Dr. W. H. Perkin.
2 Nov. 1904.

1125. (*Chairman.*) You have been kind enough to say you would come and give us some information about the early history of the aniline dye industry of which you, I suppose, may be considered to be the father, as you discovered the first dye?—Yes.

Early days of the Aniline Dye Industry. The first discovery in 1856.

1126. That discovery was made in the year 1856, I believe?—Yes.

1127. It might be interesting to the Committee, if it would not take too long, for you to tell us exactly how your discovery came about?—Very briefly—at the time I was an assistant to Dr. Hofmann at the Royal College of Chemistry, in Oxford Street, I used to work at home in the evenings and at other times when I had the opportunity in my laboratory on my own account. During the Easter holidays (1856) I was working with the desire of producing quinine artificially. The result was that I obtained a product which gave me a somewhat dirty colouring matter, but this made me apply my reactions to aniline instead of to the other compound I was then using; and in that way I succeeded in obtaining this mauve colouring matter.

1128. And you started to produce that commercially in the following year, 1857?—Yes, or rather we succeeded in producing it by that time, having built works.

1129. Did you produce it on a large scale?—Of course the production was comparatively small at first, because it was quite tentative. At first we supplied the silk-dyers in London, but when it was found that it was possible to produce the colouring matter commercially, and that it was eagerly sought after by dyers and others, considerable quantities were soon produced.

1130. How long did your firm of Perkin & Sons last?—Until I left it in 1873.

1131. Was it then transferred to other hands?—Yes, to Messrs. Brooke, Simpson & Spiller.

Methylated spirit used as a solvent and found satisfactory. No alcohol in finished products.

1132. I understand that while you were connected with the industry you used alcohol in considerable quantities as a solvent for extracting the colouring matter from the products with which it was associated, and also as a solvent for the finished product as supplied to the users?—Yes.

1133. But that you did not use alcohol as a constituent of the colours themselves?—No; it did not enter into their composition at all.

1134. Could you say, speaking from memory, what quantity of alcohol you used in the year?—I cannot now.

1135. Would it run into thousands of gallons?—Yes; it was a large quantity. We used to use it in a diluted state generally.

1136. And at that time you used the ordinary methylated spirit?—Yes.

1137. That you found quite satisfactory for your purposes?—Quite.

Alizarine colours (1869).

1138. When did you come to the alizarine colours?—I took out my patents for these early in 1869, and the same year commenced supplying Turkey red dyers and others.

1139. And there again even with those you did not require alcohol?—I did not require it at all in that case.

Pure duty-paid spirit used in isolated cases. But no difficulty experienced on account of Excise restrictions.

1140. Therefore as a matter of fact you were in no way embarrassed in your operations by the Excise regulations in respect to alcohol?—No, not at all, except that a small quantity of pure alcohol was used for some of the colours.

1141. I see that in 1864, in connection with the colouring matter called dahlia, or ethyl mauveine, which you produced from the mauve, you used ethyl iodide?—Yes.

1142. Did you manufacture the ethyl iodide yourselves?—Yes.

1143. For that you had to use duty-paid spirit?—Yes, I required it pure.

1144. In any large quantity?—Relatively it was not a large quantity.

1145. Would methyl iodide have suited your purpose equally well?—Not so well.

1146. If you had used methyl iodide then you could have used the spirit duty free?—Yes. I used the wood spirit freed from acetone for the production of britannia violet.

1147. So far as your experience went, the difficulty of obtaining duty-free alcohol did not operate to injure the industry?—No.

Reasons for transfer of industry to Germany. (1) Absence of Patent Laws in Germany and evasion of English Laws by Germans. (*See* also Q. 1190–2.)

1148. And in your opinion had not a great deal to do with the large transfer of the industry to Germany which subsequently took place?—No, I do not think it had anything to do with it.

1149. That transfer did undoubtedly take place; to what would you ascribe it?—I ascribe it first to the influence of the patent laws giving the Germans a special advantage, and then to their cleverness in being able to evade the English law by the way in which they sold their dyes, and afterwards by the scientific aid that they employed in their industries.

1150. In taking out your patents you had to specfiy exactly the method of producing the colour, had you not—Just so.

1151. That specification was accessible to anybody?—Yes.

1152. And anybody could obtain a copy of your specification?—Quite so.

1153. Germany not then being subject to any patent laws, they proceeded to manufacture in Germany from your specification?—Just so.

1154. Did you find a difficulty in preventing their goods being brought into this country to compete with your own in the home market?—At first I had no difficulty, because they sold to agents and the agents sold again to the consumers. In that case we took proceedings against the agents, which were successful, and stopped the sale of the foreign colour.

1155. (*Dr. Thorpe.*) Through agents?—Just so. Afterwards the Germans employed travellers who simply took orders and supplied the consumers direct. The consumer bought colours from us, and from them too, and these being the same chemical products when applied to finished goods, it was impossible to distinguish the foreign from the English.

1156. (*Chairman.*) And it was impossible of course for you to obtain evidence of the fact that they had got the colours from abroad?—Except by getting an order to inspect their works. That would have been difficult to do, and also very unpleasant, because the consumers being our customers we should only make them sour and hostile to us.

1157. Did you from that cause find that the sales of your firm fell off?—It prevented us increasing our production, and otherwise interfered with us, especially in causing us to reduce our prices.

1158. Were you still able, though at a reduced profit, to keep up the total of your production?—Yes.

1159. Did you export at all?—Not in those early days.

1160. Did you not export to America?—No; I think not.

1161. Apart from the patent laws, are there any other reasons which you can give for the transfer of the trade?—The use of scientific assistance. After we left, those who bought our works used only a small amount of scientfic aid, whereas they should have increased it very much. In Germany they used it with great success; and the use of scientific aid was really the second step in the development of the industry in Germany.

(2) Scientific assistance employed by German manufacturers.

1162. I suppose the firm, as subsequently conducted, was satisfied with going on producing the colours which had already been discovered, by processes which were already known, without troubling themselves to develop their scientific knowledge of the subject and without increasing the number of their colours?—That was practically so, but I think they did produce a few new products.

Present position of the Industry. Desirability of pure duty-free spirit, though Methylated Spirit still suitable for many purposes.

1163. That is as regards the past; now as regards the present time should you say that there was need of pure alcohol now, although there was no need of pure alcohol when you were concerned with the industry. In other words, should you say that at the present time the power to use pure alcohol duty-free would be essential to the industry?—I think it is desirable to have it now; it would be very helpful and very useful.

1164. Do you consider that the proportion of alcohol to be used which must be pure is larger? I take it that the methylated alcohol would be sufficiently good for many purposes still?—Yes, I think so.

1165. And that it would be only a limited proportion of the whole spirit to be used that need be absolutely pure; or do you think that the proportion would be large?—I daresay it would be considerable. Of course I am not a manufacturer now, and am not in the works, so I cannot answer that question very fully.

1166. There is a very large number of these colours that can be produced without alcohol at all, I believe?—Yes, that is so.

1167. Then there is a certain further number and there are certain uses of alcohol in connection with them for which methylated spirits is quite sufficiently good?—Yes; but I think it would be undesirable to have to use two kinds of spirit in the works, because you have to recover it, and that would complicate the work. It would be much better to have it all of one quality.

Margin of profit much smaller now than formerly.

1168. The profit on these articles now is very much less than it used to be, is it not?—Yes.

1169. In your day I understand you took a very wide margin of profit?—Of course there was a much larger profit then than now; but the colours were very expensive to make in the early days. The things which cost perhaps 30s an ounce to make then can now be made for a few shillings per pound. So that the extra price was not all margin. The cheapening is due to the greatly improved methods of manufacture and to the large reduction in the price of the materials used.

1170. We have had it in evidence that the rosaniline originally cost a very great price, is that so?—Yes, it did.

1171. I rather think we were told that it cost £3 per ounce?—I do not remember, but I know that the price was very high.

1172. Now that is to be got at a moderate price?—Yes, it is quite a cheap thing. The crystallized mauve that I made was sold at about 30s. per ounce.

Risk of misuse of spirit by workmen. (*See* also Q. 1183–5.)

1173. From your recollection of the manner in which the manufacture was conducted should you say that if you had been allowed to use pure spirit, not methylated spirit, there would have been any great difficulty in keeping a satisfactory check upon the spirit to prevent its misappropriation?—There might be a difficulty with the workmen perhaps.

1174. Would many of the workmen have access to it?—Yes, they would.

1175. Individual workmen not working under immediate supervision?—Yes, because the spirit was constantly passing backwards and forwards, being used and redistilled and so on. But supposing it were a pure spirit to start with in the course of the operations it would certainly become less potable.

The allegation that Excise Regula-

1176. Let us take the twenty-five years following 1873; during those twenty-five years have you heard

Dr. W. H. Perkin.

23 Nov. 1904.

from people connected with the trade complaints as regards the cost of alcohol?—Not directly connected with the trade, but I have heard it in conversation in a general sort of way.

tions have injured the industry in this country is of comparatively recent date.

1177. What is your impression as to the period at which the question of alcohol began to be discussed at all?—I do not know.

1178. It would be long subsequent to 1873?—Yes, long after that period.

1179. Could you, for instance, say that before 1890, the people who were engaged in the trade in this country were themselves feeling the pressure of the alcohol regulations?—I never heard of it.

1180. Speaking generally may one say that it is within comparatively recent years that the suggestion has been made that the Excise regulations in regard to alcohol have seriously affected the industry as carried on in this country?—So far as I know.

1181. I suppose you have kept more or less in touch with the business, have you not?—Yes, I have come in contact with people connected with these dyes more or less, but not to a great extent during the last few years.

1182. Still you probably would have heard of it if there had been any strong feeling on the subject?—Yes, I quite think so.

Risk of misuse of spirit by workmen. (*See* Qs. 1173–5.)

1183. (*Dr. Thorpe.*) With respect to the possible difficulty of controlling the use of alcohol among the workmen and preventing their illicit drinking of it, I suppose you yourself found that that was an occasional difficulty?—One or two workmen were reported to have been drinking methylated spirits mixed with beer; that was the only thing. There were one or two men with rather drinking propensities, but I only heard of it once or twice, and I did not know of it from real personal observation.

1184. We have been informed that the very fact of the association of alcohol with what the workmen call "chemicals" in a works is quite a sufficient deterrent; would that be your impression?—I think so. I do not think they would touch it if it was in actual use.

1185. Supposing it were recovered spirit, re-distilled spirit and stored, would the fact that it had been recovered and that it had been at some time in association with what are called "chemicals" be a sufficient deterrent in your opinion?—Yes, I think it would. But, of course, the mania for alcohol is so remarkable that it is very difficult to speak positively.

Racial characteristics as a factor in German success.

1186. There is another point on which you can perhaps inform us. We were told yesterday that the Germans are from their national and racial characteristics pre-eminently persons who are likely to develop an industry of this kind, more than English people are. I am not speaking about their educational equipment, but merely that their racial characteristics make them more prone to take up and develop an industry of this kind than would be the case with us in England. Do you think there is a real foundation for that statement?—There is no doubt they are people who study economies a great deal in their works and in the methods of manufacture, and that would be an advantage.

1187. Is there anything in their characteristics which would lead them to develop the manufacture of what are called "fine chemicals" more than an English chemical manufacturer?—I think so.

1188. You have been in association with Germans; you have seen Germans over here, and you know generally what German chemists and German chemical manufacturers are like; do you recognise any national characteristics which would give them a pre-eminent advantage?—Yes, there is an advantage in their regard to details. They are very plodding and very persevering in their work—more so, I think, than we are.

1189. The point of course has reference to the possibility of our eventually recovering any considerable fraction of this class of manufacture; we have been given to understand that it was practically impossible to hope that such would be the case on account of that fundamental difference. Do you think there is anything in that surmise?—I should not think it impossible, but it would be very difficult to compete with them now, except in the case of newly discovered products.

Patent Laws. Date of introduction in Germany. (*See* Q. 1149, etc.)

1190. (*Dr. Somerville.*) When did Germany obtain the Patent Laws which prevented her manufacturers taking advantage of our discoveries?—I forget when the Patent Laws came in; I think it was some time after the war with France, but I am not sure.

1191. Then I suppose that at present it is impossible for German manufacturers to do what they did in the fifties and sixties, namely, to get our specifications and to proceed to manufacture according to them, and to export such goods to this country?—If there is no patent in Germany there is no difficulty still; but of course English patentees now take out patents in Germany as well as in this country.

1192. Under the present conditions they can, but originally they could not do so?—That is so.

Chemical research in German works: its extent and results in developing new branches of industry.

1193. You state in your *précis* that there are 195 chemists employed by the *Badische Anilin und Soda Fabrik;* do I understand that these 195 chemists are almost entirely concerned with the supervision and the control of the aniline manufacture as opposed to the other departments of that large concern's business?—Their work is various. A great many of them have research work, and have nothing to do with the works at all. Others have to do with the working out of new processes and developing them and others with the general supervision.

1194. But concerned with aniline and with its derivatives?—Not all; but I believe most of them are engaged with aniline colours, as they are commonly termed.

1195. Does this factory concern itself entirely with colouring matters, or does it conduct other departments of manufacturing chemistry?—It manufactures all the products it requires, such as alkali and acid products. I am not sure whether it sells those in open market, but I understand that it makes all the chemicals it requires for the manufacture of dyes.

1196. Can you give the Committee any idea of the proportion these experts chemists bear to the ordinary workmen?—There was a paper published recently which gives the number of workmen as 7,531, including inspectors and mechanics.

1197. I suppose that in this country we have no example of the employment of highly trained scientific labour to anything like that extent?—No.

1198. (*Dr. Thorpe.*) Is it not the fact that when these research chemists discover substances which are found to have a technical application other than in the manufacture of dyes—that technical application may be in photography, or even in medicine—the discovery is at once taken advantage of by the firm?—It certainly is in medicine, but I do not know whether it is in photography by the *Badische;* but I know it is by some of the other works.

1199. You are not aware, then, that at the present time the *Badische Anilin und Soda Fabrik* make considerable quantities of photographic developers?—It is quite likely, but I do not know.

Question of a suitable denaturant for spirit used in Aniline Dye Industry.

1200. (*Mr. Tyrer.*) I should like to ask you whether you consider that the methylated alcohol as you knew it, and I think I may say as we know it now, for there has been no real change lately, was the only form of alcohol which commended itself to you as a manufacturer; or, to put it in another way, alcohol pure and simple was not absolutely necessary to you?—No, it was not.

1201. The methylation, in your experience, as I understood you to say, was not a disadvantage; but with the progress in the production of a variety of colours the presence of the impurities which are associated with the present methylated spirit might be a disadvantage?—Yes.

1202. Have you any opinion as to the method of denaturing alcohol suitably for the recent, or anything like the recent development of colours?—Of course the only safe way would be to put in products that would be used in the special manufacture it was wanted for. The acetone in methylated spirit probably would be injurious in some cases.

1203. Taking methylated spirit as it stands, and taking your actual range of experience as a manufacturer, and also taking your great reading in following, as you naturally would do, the development of these colouring matters, what do you think would be the most universally appropriate denaturant other than commercial wood

naphtha ?—I should think it would be very difficult to find a universal denaturant.

1204. Therefore the phrase which we have got accustomed to—"suitably denatured"—would have to be a question of individual experiment and decision ?—Yes.

Pyridine bases.

1205. Have you any views with regard to the universal or anything like the universal desirability or applicability of the pyridine bases, for instance ?—Of course the pyridine bases could be very easily separated in the work by distillation with acid.

1206. Take a spirit denatured with pyridine in addition to wood naphtha. At present 10 per cent. of wood naphtha is used, but suppose 2½ per cent. were used in order to meet some objections, and then pyridine was added in order to make it more nauseous at the first stage, would the subsequent distillate, in your opinion, be possibly potable ?—I do not think so, even if acid were used.

1207. What about the pyridine, the wood spirit being reduced to 2½ per cent. ?—The pyridine could, of course, be all removed, and you would then simply have 2½ per cent. of wood spirit.

1208. Even that would be undesirable as a drink ?—Yes, but it would naturally be less nasty than if it contained 10 per cent.

1209. But reducing the volume from 10 per cent. to 2½ per cent., would it be possible to detect it ?—I should think so.

Relative importance of alcohol in the industry at present time.

1210. The number of colouring matters has, of course, enormously increased, but I understood you to say that those in which no ethyl or methyl derivatives were contained, or in the production of which ethyl alcohol or methyl alcohol is necessary, are increasing. Putting it in another way, should you say that the number of colouring matters in which those products are required either for the purposes of manufacture or as condensation products is increasing ?—I think the number of products requiring ethyl and methyl radicals is certainly increasing.

1211. (*Dr. Thorpe.*) Do you mean absolutely or relatively ?—I do not say that the percentage is becoming any greater, but of course new compounds are constantly being discovered.

1212. Having regard to the number of those new compounds which are being discovered, does alcohol in the form of methyl or ethyl alcohol obtain to a larger relative extent than it did formerly ?—Not that I am aware of.

1213. (*Mr. Tyrer.*) We have had it presented to us, not very clearly, but at least the impression left on my mind was that of late the number of these colouring matters in which an ethyl or a methyl radical was necessary had decreased; we have also had evidence to the contrary. It is interesting to hear from you, not now directly interested in the manufacture, but watching it, of course, with a fatherly interest, that they have not decreased. Your answer to Dr. Thorpe, is, as I understand it, that relatively the number is about the same ?—Yes, but, of course, I can only speak in a general way. To be accurate one would have to go through all the list of colouring matters.

1214. It is an important fact from one point of view of course that the use of methyl alcohol on the one hand and ethyl alcohol on the other is still continued ?—Yes.

1215. Because if their use were ceasing then the question we have in hand is not quite so important a one relatively ?—Of course, there might in some years be a greater run on a certain class of re-actions giving colouring matters containing ethyl or methyl alcohol, and then for other few years it might be the reverse. It is very difficulty to speak with certainty.

See Q. 850

1216. In that connection a previous witness as I understood him made a rather striking observation that the number of patents has decreased; as far as your observation goes is it a fact that the number of patents for colouring matters has decreased ?—I do not know. I have not studied the patent list.

Chemical training in this country.

1217. With regard to highly trained chemists, I should like to ask whether in your opinion the tide has turned in this country as regards our supply of chemists who are equal to a demand should it arise for work of the kind which has been so successful in Germany, and for which they seem to be so eminently fitted personally and by education ?—I do not think there are as many young men studying technical chemistry as there might be; that is on account of the want of sympathy on the part of the manufacturers. A young man becomes a trained chemist, and he goes to a works; they usually engage him for a certain number of years only, and then when they think they have got all the information they can from him, and his time is up, he is turned adrift. The young men find that this is a very unsatisfactory state of things, and therefore do not care to go in for technical chemistry so much as they otherwise would.

1218. In other words, the method, of which we have excellent evidence, of showing their appreciation of the results of research by some sort of increased payment, dependent, of course, upon the profits which have resulted from that particular research, while prevailing in Germany to an almost universal extent, does not prevail here ?—I cannot say. It did not some time ago; but I do not know what is being done now.

1219. So far as the training is concerned, the fitting out, in fact, of the men for such work as the development of the coal tar industry and research work in connection with these synthetic chemicals, pharmaceutical products, photographic developers, and so on, which have been referred to, the state of education here is infinitely better to-day than it was ?—Certainly. The difficulty is that young men will not study long enough, and do not seem to look upon research as being such a useful thing as it is.

1220. In that connection do you think that the concession under the Finance Act of the use of pure alcohol duty free to selected and approved research laboratories is a step in the right direction ?—I think it is a great advantage.

1221. Do you agree with the—shall I call it dictum—of Professor Armstrong that all research should be encouraged and ultimately leads to industrial development—he was speaking of chemical research, and was replying to a question similar to the one I put to you a moment ago ?—Of course, that is rather a large subject, but there is no doubt to a great extent it does, if not entirely.

1222. It goes to prove that without some sort of risk, that is to say without some sort of enterprise in the direction of research, manufactures are likely to be stagnant, and even to recede ?—Quite so.

Greater cost of chemical education in England as compared with Germany.

1223. (*Dr. Thorpe.*) Is not one very considerable factor in the situation as between Germany and this country the disparity in the cost of chemical education in the two countries ? Cannot a person get that equipment which we now recognise to be necessary at a less cost in Germany than he can here ?—Yes: and, of course, that is a very important matter for young men.

1224. It is the fact to begin with, is it not ?—Yes, it is the fact.

1225. And it is a very important point for consideration ?—Yes.

1226. (*Dr. Somerville.*) Were the fees which Baeyer used to charge in Munich distinctly lower than the fees which would be charged by a first class chemist in this country ?—They were much lower than in this country.

Alizarine. Home production and importation compared.

1227. (*Chairman.*) There is one other point in your *précis* that I meant to ask you about. You state that considerable amounts of colouring matter are still being produced in this country, and then you go on to say that the British Alizarine Company, "the survival of Perkin and Sons' old business, produces all or nearly all the Alizarine and its derivatives used by the Turkey Red Dyers and Calico Printers of the United Kingdom." Are they the present successors of your original firm ?—Yes. They are not the immediate successors. It passed through two hands first, Messrs. Brooke, Simpson and Spiller and then Messrs. Burt, Boulton and Haywood.

1228. Are the British Alizarine Company now occupying the premises you used to occupy ?—No, the works were removed.

1229. You state that that particular company produces all, or nearly all, the alizarine and its derivatives used by the Turkey Red Dyers and Calico Printers of the Kingdom; that must be a large quantity ?—Yes, it is. But of the derivatives of alizarine I think they only make one, namely, alizarine blue.

Dr. W. H. Perkin.
23 Nov. 1904.

1230. Turning to the Trade Returns, and taking the figures for 1903, I see that the total amount of Alizarine imported in the year 1903 was valued at £275,000. That represents a considerable quantity, namely, 59,000 cwts., there being 162,000 cwts. of aniline imported in the same years. On those figures therefore the imports of aniline colours were about three times the value of the imports of Alizarine colours. What proportion of the total consumption would this 59,000 cwts. represent?—I believe the British Alizarine Company produce 50 or 60 per cent. of the alizarine red used in the United Kingdom. The Board of Trade Returns include not only Alizarine Red, but Alizarine Green, Alizarine Blue, Alizarine Yellow, Alizarine Black, etc., which are used largely in the woollen trade as well as Alizarine Red.

Question how far importation of certain dyestuffs is due to restrictions on the use of alcohol in this country.

1231. Again I am going to ask you a very wide question, and I do not know whether you will be able to answer it. Taking the import list, what I find is that the total value under four heads, which seem to me to cover the synthetic dyes, namely, alizarine, aniline, indigotine and extracts, taken together, give you £1,800,000. Should you suppose that a large proportion of these require alcohol for their manufacture; should you say, for instance, that half of those would?—No, not half.

1232. Perhaps not even a quarter?—Perhaps not. Its use is chiefly connected with the aniline dyes.

1233. That might account for the fact that three times as much of the aniline dyes are imported as of the alizarine dyes, because alcohol being required in them our manufacturers are less able to make them, and therefore we import more; would that not be so?—I do not think that is the reason. I think it is because the industry is chiefly on the Continent.

1234. (*Dr. Thorpe.*) And also because they are themselves protected by their patent rights there?—Yes.

1235. (*Chairman.*) I will put it in this way; aniline is the class of dyes in which we are at a disadvantage, if we are at a disadvantage, on account of the alcohol?—It is a very difficult question, because in a very large proportion of the diazo compounds, for instance, alcohol scarcely enters at all.

1236. Is it the same with indigotine?—I do not think so.

1237. (*Dr. Thorpe.*) May I put it also that these diazo dyes do enter very largely into the very things you are enumerating?—Yes, the aniline dyes.

1238. They are the most abundant of them?—Yes.

1239. (*Chairman.*) These figures seem rather instructive in this way. Assuming that those pretty well exhaust the imports, we have a total of £1,800,000, and you tell us that you would not expect that more than perhaps £500,000 worth of that was in any way concerned with alcohol, so that it seems to reduce to more moderate proportions than some figures one has sometimes seen the extent to which we are dependent upon foreigners for those dyes by reason of the alcohol difficulty?—I do not think the alcohol has much to do with it myself.

1240. Not even now?—No.

Revival of Alizarine Industry in England. The British Alizarine Company.

1241. (*Mr. Tyrer.*) Is it not the fact that the alizarine industry in this country has been to some extent—I do not like to use the word, but it is the fact, I believe—bolstered up or sustained by a combination? Is it not also the fact that it might easily have been driven out, and was within measurable distance of being ruined, had it not been for the commercialism and good sense which animated both sides and led to an agreement by which the Germans, while not consenting to remain altogether out of this country, agreed to reduce their importation to this country; and is it not the fact that there is only one works in this country—namely, that of the British Alizarine Company, at Silvertown?—I believe there is an agreement now as to the selling price, but that it has not existed for many years.

1242. And that company is in very intimate association with their foreign rivals and competitors, and it is the fact that the industry has been held in this country by a competition of brains as well as commercial instinct?—The formation of the British Alizarine Company came about, I believe, in this way: Our first successors, Brooke, Simpson & Spiller, did not succeed well as alizarine manufacturers, but their successors did much better and to some extent, recovered the trade. Then the business was formed into the British Alizarine Company, consisting chiefly of the turkey red dyers and calico printers. They felt that they were quite in the hands of the Germans, and that if alizarine was not manufactured in this country at all, the Germans might alter prices just as they liked, so they took to this business to protect themselves. When the Germans tried to increase their prices, they then used their own make, and when the Germans sold at very low prices, they diminished their own output. In that way the British Alizarine Company kept themselves in a safe position, and now, having proceeded with the manufacture, I believe they can work equally well with the Germans, and I heard some time ago that they had come to an agreement with the German works as to the selling price.

1243. They found themselves quite equal in experience as the result of what has been said about research and all the rest of it, and were able to make terms on an equal footing with the Germans?—Yes.

1244. Might I ask you to take a table which I quoted in my paper ("Journal of the Society of Arts," No. 2684, page 515) which was prepared by Mr. Leuthardt-Thornton, and shows the spirits used per £100 import value; and to furnish us with any criticism you may have upon it?—I should be pleased to look at it.

1245. (*Chairman.*) It is a very long table, and deals with a great many articles, some of which may have been produced since you retired from the business; possibly you might be able to give us a criticism upon those with which you are familiar?—It is very doubtful whether I could, because I am afraid I should not have the data now.

1246. Perhaps you will look at the table, but unless you feel able to make positive and definite criticisms upon particular products, it would perhaps be better to leave it alone altogether?—I fear anything I might be able to say in reference to it would be of but little value.

Mr. Charles Pierce Merriam, called; and Examined.

Mr. C. P. Merriam.
23 Nov. 1904

British Xylonite Company Practical working of concession under Finance Act 1902.

1247. (*Chairman.*) You represent the Xylonite Company?—I do.

1248. Where are their works?—The works in which pure spirit is used are at Brantham, in Suffolk.

1249. The use of the pure spirit has been authorised under the Act of 1902; since what date have you been employing the pure spirit?—Since the 22nd May, 1903.

1250. Would you describe to us the exact arrangements under which you have to work now with regard to the pure spirit?—We receive the spirit and put it into a bonded warehouse which is under the control of the Excise officials.

1251. Is there an Excise official constantly in attendance?—Yes, there are three officials whose duties are exclusively to attend to our work.

1252. Are they there night and day?—No. They occasionally have to work in the evening, but it is not often.

1253. Then at night, when the works are closed, there is a revenue lock, I suppose, put upon the building?—Yes.

1254. What quantity of spirit do you keep at one time there?—I cannot say from memory; I did not know I was to be asked that question.

1255. Is your warehouse a large one?—No, our warehouse is a small one.

1256. What number of casks would there be in it?—I should think about ten puncheons—I am speaking quite from memory. It is a small quantity and we have to get it in frequently.

1257. What strength spirit is it?—Sixty-five over proof.

1258. Do you get it direct from a distillery or from a warehouse?—We get it, I suppose, direct from a distiller.

1259. Or possibly from a duty-free warehouse?—That I really do not know. It is being supplied to us by two British firms of distillers, but whether it comes direct or through one of their warehouses I really do not know. I suppose it comes direct.

1260. Having got this spirit into your warehouse, what are the regulations as regards the issue of the spirit for the purposes of the works?—There are certain rooms in the works in which the spirit is used—three or four, I think; and those rooms are under the control of the Excise officers. There the spirit is mixed with other solvents and denatured. It is denatured with camphor; we are obliged to mix camphor with it.

Camphor used as a denaturant.

1261. Is it denatured before it gets into the hands of the workmen?—Yes.

1262. What is the formula which you have to follow—is it so much camphor to the gallon?—Yes, but I cannot give you that figure out of my head. Of course we have followed exactly the regulations laid down for us by Somerset House.

1263. Do you remember whether there is any other denaturant than camphor?—I think there are several others allowed, but I do not think in practice we use any other but camphor, or if we do, it is only on very special occasions.

1264. For a time, so long as camphor is present in the spirit, does it render it quite unpotable, do you consider?—Yes, we do.

1265. The camphor does not interfere at all with the suitability of the spirit for your purpose?—On the contrary, we cannot use it without.

1266. You have to use the camphor at some time or other?—Yes.

1267. Do you remember what quantity of spirit you use in the year?—Yes, I have got those figures, as I had them taken out to the end of last month. The quantity is a little over 75,000 bulk gallons per year.

1268. Prior to the 22nd May, 1903, when you began to use the duty-free spirit pure, what did you do?—We used methylated spirit.

1269. Entirely?—Yes, for the same purposes.

Quality of article produced better than when Methylated spirit was used, and more able to meet competition with imported Xylonite.

1270. Was that what we call the ordinary methylated spirit with 10 per cent. of wood naphtha?—Yes.

1271. Was that injurious to the manufacture?—Yes. The wood naphtha that is put in is, in our view, an adulterant really. The manufacturer of the methylated spirit was in a difficulty; he could not have the methylated spirit too good, or he would get into difficulties with the Excise officers, and therefore we never got it of so good a colour as we should have liked.

1272. Did it affect the colour of the product?—Yes.

1273. In what way; did you not produce the same pure white?—That is so. We make, for instance, many delicate shades of imitation ivory, and the effect of a dark spirit would be to make those have a tendency to be brown—it would have a browning tendency upon all those shades.

1274. Are you satisfied that the product that you now make with the pure spirit is a superior article to what you made before with methylated spirit?—We consider that our shades are better.

1275. Has it enhanced the price on the market?—I am afraid it has not, because our competitors are chiefly foreign competitors, and they are undoubtedly not using methylated spirit—they are using pure spirit.

1276. And always have?—They always have done.

1277. Do you find yourselves better able to compete with the imported articles, now that you have got duty-free alcohol?—Undoubtedly we do.

Direct cost of Excise supervision

1278. Those are the advantages. As regards the disadvantages,—you have something to pay?—Yes, £400 per annum.

1279. Is that a fixed sum?—Yes.

1280. That is not wholly chargeable to this use of pure spirit, is it?—Yes.

1281. Ought it to be debited wholly to the Excise regulations, because assuming we left you perfectly free would you not as a matter of fact have to pay some part of that £400 for supervision of your own, which perhaps now is exercised by the Excise officers?—I do not think we should hire an extra officer in addition to the supervision that is constantly being carried out by our managers in the works.

1282. You would not?—No, I do not think that would be necessary. Of course we are glad to have the check of the Excise officer, but if the Excise officers were not there I think that our ordinary staff would be sufficient. I do not think we should hire an extra person.

1283. That £400 per annum is the measure of the burden that the Excise arrangements put upon you?—Yes, that is so.

Such cost regarded as less burden than the indirect effect of Excise restrictions in the shape of increased cost of spiri and the differential duty on imported spirit.

1284. But you consider that you have got full value for that in the improved character of the product?—Yes.

1285. Are there any other matters which you might lay to the charge of the Excise arrangements?—I do not know whether the members of the Committee have read the *precis* of my evidence; I have stated the remaining grievances there.

1286. I do not understand you to regard the £400 per annum as a serious grievance?—It is only to the extent of £400 per annum that is all.

1287. You mention in your *prècis* a further drawback, if I might put it so, to the present arrangements—which is the duty known as the differential duty upon imported spirit?—Yes.

1288. As a matter of fact, do you use imported spirit at all?—We never have done.

1289. In fact the price of the imported spirit, plus the surtax, would be more than what you have to pay for the British-made spirit?—Yes, at the present moment.

1290. You know, of course, the principle upon which that differential duty is based?—I have always understood that it was in order to compensate the distiller for the difficulties under which he labours, that is to say, he is under certain restrictions in the same way practically as we are, I suppose, except, I think, he does not have to pay any amount for Excise supervision; and for these restrictions, in compensation he is allowed a duty. That I understand to be the principle.

1291. Supposing the 75,000 gallons were cheapened by the amount of the surtax, or say they were cheapened by the amount that we allowed a distiller when he exports his spirit, which is 3d., that would cheapen your spirit by nearly £1,000 a year, would it not?—The differential duty is on the proof gallon, and the 75,000 gallons I have given you are bulk gallons—so it would be many more proof gallons.

1292. So it would be more like £1,500 a year?—I should think it would be quite that; but I have not worked it out. It is an appreciable amount.

1293. That, so far as it goes, is a heavier tax upon you than the £400 a year for supervision?—Undoubtedly it is much heavier. I have not worked out the actual figures, but there is no doubt of that.

1294. I see you thoroughly understand the principle of the thing, which might under other circumstances apply to you; that is to say, if you had to pay £400 a year for Excise supervision and another £1,500 a year indirectly owing to Excise regulations on your products, you would not like a competing produce to be admitted into this country without any sort of compensation to you?—Of course that is the whole point. In my opinion the law provides a remedy for us which up to the present has not been carried out.

Question of a Customs duty on imported xylonite.

1295. In what way?—I have mentioned in my *prècis* that there is an Act of 1876 which provides for an exactly similar case to ours.

1296. Are you alluding to the Customs Tariff Act of 1876?—Yes. I have brought that Act before the Commissioners of Customs and before the Treasury, and I have never been told yet that my contention was wrong.

Present state of law affecting this point.

1297. It is rather a difficult point, but as a matter of fact, whatever might have been said about it, nothing can be said now, because that provision of the Act of 1876 is no longer law. In 1903, when the Revenue Bill was introduced, they repealed that provision in connection with

Mr. C. P. Merriam.

23 Nov. 1904.

Clause 2, which was dropped out—so unfortunately that weapon is no longer availiable ?—Then the soap manufacturers, I suppose, are no longer protected to the extent of their 3d per lb.

1298. Yes, they are, because it did not repeal things which were already on the tariff, but the effect of what Parliament did then is to prevent anything being added to the tariff. Of course you are aware that the difficulty in applying that provision of the Customs Tariff Act, 1876, was that the provision contemplated an article which was made in this country with duty-paid spirit. Now you were not using duty-paid spirit; you were using methylated spirit; and therefore, although possibly under the letter of the Act of 1876 it would have been possible to put on a duty, yet it would not have been possible to put on any less duty than a duty based upon the duty-paid spirit of 11s. per gallon, which would have been a very high one ?—I am quite aware of that. I think I ought to say that I think the clause which the Chancellor of the Exchequer introduced this year was to put that right in a way.

1299. That was so. What was intended by the clause of 1903 was to give the Treasury power to impose an import duty either on the basis of a full duty on the spirit, or on the basis of the slight extra duty or charges which are connected with methylated spirit ?—I thought the object was to put on a duty which should be commensurate with the differential duty we had to pay.

1300. It was to put on a duty which, taking all the circumstances into account, would have put the imported article and the home made article on an exactly equal footing, or as nearly as possible on an equal footing. Do you consider that that enhancement of the cost of the spirit, which is ultimately due to the rather severe restrictions which have been placed upon the manufacture of spirit in this country, and which is estimated at the present time to represent about 3d. per proof gallon on the spirit that you use, is rather a material burden upon your industry ?—Yes, I think it certainly handicaps us against our foreign competitors. Our chief competitors are the German factories.

Quantity of imported xylonite.

1301. At the present time is the amount of imported xylonite large ?—Yes. It is very difficult to state figures, but I do not think I should be far wrong in stating that there is rather more imported than is made here.

1302. But still, roughly speaking, one might take it, you think, at about half ?—That is a rough guess; I do not know whether there are any figures.

1303. What would the imports be entered under, do you know ?—"Celluloid" probably.

1304. Are they not entered separately ?—Celluloid comes in under so many headings; there are so many things made out of celluloid that it would be probably rather difficult to get at it.

1305. It is used for knife handles and as a substitute for ivory and for bone, I suppose ?—For ivory, for vulcanite, for horn, for coral—indeed, there are endless things made out of celluloid—combs, brush and mirror backs, mirrors, photographic films, all kinds of things.

1306. Each of these would, probably, be entered under those separate headings ?—Yes, so I think the total figure would be rather difficult to ascertain. Whereas there are five factories in Germany making celluloid, until quite recently we were the only factory in this country. That gives you some idea of the extent of the imports. Then there are five factories in France. A factory has been started quite recently in South Wales, and one of the vulcanite companies makes a small quantity of celluloid.

Xylonite factories in Germany. A drawback believed to be allowed on export.

1307. (*Dr. Thorpe.*) Have you any means of knowing the number of hands employed in the five factories in Germany ?—I do not know the number.

1308. Are they individually larger or smaller factories than your own ?—With regard to the production of celluloid, the chief German factory is, undoubtedly, much larger than ours. I do not think the number of hands employed would really give a true index, for the reason that this factory makes out of the celluloid hardly anything. It makes one or two things, but they sell their sheets and rods and tubes to manufacturers. We have gone rather on the opposite principle and we employ between 1,100 and 1,200 people; but the larger number of those are employed in the manufacture of articles made from xylonite.

1309. (*Chairman.*) You refer in your *précis* to a bounty which you say is paid by the German Government, upon the export of celluloid and celluloid articles; that is, I suppose, in the form of a drawback on the charge for the spirit used ?—Yes.

1310. Then, in fact, they do not work with duty-free spirit in Germany ?—I do not think they do, but I think the drawback that they get is a large amount of the duty that they paid. I have not very exact information as to that, and I think it varies in different parts of Germany; but that there is a bounty paid I have not the faintest doubt. We have it really on the best authority.

1311. Do you know what the figures of the drawbacks are ?—No. It is paid through what is known as the *Centrale für Spiritus Verwerthung*. That is practically the trade ring of Germany.

1312. That is not the German Government; it is the Trade Syndicate, the Cartel of the trade ?—That is so, but I think that undoubtedly they get it from the Government in turn.

1313. They do get it from the Government ?—Yes; it is simply a mode of collection.

1314. That seems to imply that on the celluloid which goes into consumption in Germany itself, the duty is not re-paid. Do you know whether they re-pay the duty ?—That I do not know.

British product able to compete in Germany. *See* also Q. 1369–72.

1315. Whether they do or not, I suppose, does not very much matter to you, because your celluloid, if it arrived in Germany to compete with their celluloid, would be met with a high duty ?—No.

1316. Would it not ?—No, except on manufactured goods. On what we call raw celluloid, that is, sheets, rods and tubes, although there is a duty, it is a nominal duty; and we do, as a matter of fact, compete. Of course we do not make the profits that our German competitors make.

1317. You would have an advantage over the Germans if the Germans only got the duty repaid on so much of their goods as they exported ?—That is assuming that the German excise tax is less than ours.

1318. You have only this indirect £400 and the increased cost of spirit ?—I suppose it really amounts to more than half our spirit bill.

1319. More than half ?—The tax is 5d. per proof gallon, so it would be about half, I should say.

Finance Act, 1902, on the whole a substantial advantage.

1320. On the whole, may we take it, that you are satisfied with the arrangements that have been made by the Excise Department, under the Act of 1902, in order to enable you to use duty-free spirit ? Apart from the question of charging you so much for it, and apart from the enhanced price of the spirit, you have no complaint to make, in all other respects the arrangements are quite satisfactory ?—Quite. There is no doubt at all that the operation of Section 8 of the Act of 1902 has been a distinct gain to us, and yet we think we have some grievance remaining, which I have set forth in my *précis*.

1321. Still, so far as it goes, it has been a great advantage ?—Undoubtedly.

1322. Would you say a substantial advantage ?—Yes.

Effect of methylated spirit in imparting its colour to finished xylonite.

1323. (*Mr. Tyrer.*) You state the methylated spirit influences the colour of your product; are we to take it that the methylated spirit as usually supplied is not colourless ?—It is not quite.

1324. And that your substance, xylonite, has the power of taking out all the colour, and in fact of assimilating whatever colour there is in the methylated spirit ?—Yes. If the methylated spirit is off colour we should be liable to have the material made from it to a certain extent also off colour.

1325. Supposing you had methylated spirit that was not coloured, how then ?—As far as our experience goes you cannot get it. If it was really a very good colour it would very probably not be passed by the Excise officers. The methylator is in a difficult position; he has got to satisfy us, and he has got to satisfy the Excise officer. If he made the spirit too good it would not pass the Excise officer; if he did not make it good enough it would not suit us.

1326. May we take it as a correct inference that colour is a quality which the Excise officer regards as of some

importance? I was under the impression, speaking from some experience, that the colour might be as white as pure spirit, and that the Excise people cared absolutely and entirely, not for colour, but for the methyl contained, that is to say, for the denaturant being in accordance with the regulations. In other words, assuming the wood naphtha was colourless or water white, and the spirit was water white, that they would not say: This is too white, or too colourless?—That is not my view.

No condition as to colour prescribed by Excise regulations as to wood naptha for methylation.

1327. (*Dr. Thorpe.*) That is important. Have you actually been checked in your use of methylated spirit because it has been water white?—We have always been told so by the methylators. When we have complained of the spirit being off colour they have always said: We cannot make it too good, because then it would not pas the Excise.

1328. Have you ever seen our methylating regulations?—I do not think so. We have never methylated ourselves.

1329. You do not know what the conditions we lay down as to the wood naphtha are?—No, I do not know anything about that.

1330. There has been nothing said in our regulations to the effect that it must be of a certain colour?—I am only repeating what we have been frequently told by the methylators.

1331. (*Mr. Nicholson.*) It has not absolutely happened to you at your works in the past that methylated spirit has been stopped on account of its colour?—No. But it would not be stopped at our works; it would be stopped at the methylators.

1332. (*Dr. Thorpe.*) This colouring arises from the empyreumatic matter and the pyridine in the methylated spirit, which, in the course of time, does change its colour. It is an incident in the employment of wood naphtha, but we do not insist upon it, and it is never so stated in black and white. As I say, it comes about in the course of time?—Then it would come about in time in our own manufacture; it would develop?

1533. Yes. The real point is that there is no restriction of that sort imposed npon you as a condition precedent?—But I think in practice it works out like that.

1334. You are right; in practice it comes about that the methylated spirit becomes brown?—That is so.

1335. (*Mr. Tyrer.*) I was leading up in order to get to this point, which, I believe, is clear: When you have got methylated spirit as distinct from pure spirit, suitably denatured, you have in it an element of deterioration, and the colour has a tendency to show itself at once, quite out of proportion; that is to say, supposing you take a finished batch and then compare the colour—if any ratio can be found, and, of course, by experience it can be found, with the spirit used—the colour is more intensified in the product than in the spirit used, and it goes on browning?—Yes.

1336. I have looked into this matter myself, and I am bound to say that while the causes are those which Dr. Thorpe states, yet it would be from this point of view impossible so use with benefit, particularly in view of what your competitors use, a methylated spirit in which are these products which Dr. Thorpe has referred to as part and parcel of the denaturing agent as now applied?—Yes.

1337. (*Dr. Thorpe.*) You can get over your difficulty by having the methylated spirit used freshly made, because, as the browning is only a circumstance of time, it does not come on immediately, but it will necessarily come in the product if the methylated spirit were made from even water-white materials, but were not promptly used?—Should we not then have any bad after-effects?

1338. You would not have this discoloured celluloid?—I am not in any sense a chemist, and I can only tell you from practical experience that when we were using methylated spirit we were constantly having troubles about colour, and since we have been using pure spirit we have had hardly any.

1339. (*Mr. Tyrer.*) While I think what Dr. Thorpe has said is of immense value, I have never seen anything made under those conditions knowingly; but I have seen absolutely fresh xylonite which, at any rate, I must have had within two or three days of its manufacture, and its colour had then, undoubtedly, got brownish; so from that point of view there had been a disadvantage in using methylated spirit there?—Yes, and that is our view.

1340. It would be very interesting to adopt Dr. Thorpe's suggestion and, having obtained an absolutely water-white methylated spirit, to see what the effect would be; it would not only be most interesting, but it would also be useful to you, would it not?—Yes.

1341. (*Dr. Thorpe.*) I do not think you would have much inducement to make such an experiment, except as a matter of scientific knowledge, would you?—No, I think we are very satisfied with using pure spirit. Besides, I think the proposal to use freshly-made methylated spirit would involve methylating ourselves.

Price of spirit. (*See also* 1359.)

Effect of the surtax.

1342. (*Mr. Tyrer.*) You have referred to the surtax; do you regard the surtax alone as the only difficulty in your way? Or, turning the question round, suppose the surtax were taken off—I will not say to what extent, but in some form or other—would the cost of the spirit be lessened?—Undoubtedly, at some times it would. I have had spirit offered me from abroad at something in the neighbourhood of 4⅛d. per proof gallon. That, I think, was an exceptional price.

1343. To-day it is nearly double that, is it not?—It is much higher to-day. That, I think, was about a year and a half ago, or perhaps two years ago.

1344. Of course that is disregarding any question for the moment of putting a tax on any kind of imported spirit and relieveng home products?—Yes, it is quite irrespective of that.

1345. It is ignoring that question altogether?—Yes. This price that was mentioned to me was, of course, in bond.

1346. In your consideration of that matter you are ignoring what is a debatable question at the present time—namely, whether the home industries should be protected, even in a small degree, so as to throw the balance, if possible, on the home side?—Yes.

1347. You found the denaturant which has been prescribed by arrangement and experiment with the excise and yourself—namely, camphor—eminently satisfactory?—Yes, we are quite satisfied with it.

Strict Excise supervision welcomed, except for necessity of paying for it.

1348. You said you were worse off to the extent of £400, and you said, I think, that the officers were not there all night except when overtime was necessary, and then, of course, by permission their attendance was allowed. But I understood you to express an opinion that your own staff, with the locks which are provided, and the precautions for security, seeing that this place is left all night now, might be all the supervision necessary, and that you could do without the services of a stationary officer?—Do you mean from our point of view?

1349. Yes?—Of course I do not suppose from the excise point of view, it would be allowed. My position on that is simply this: We are glad the excise officers are there; our interests and the interests of the excise authorities are one. We cannot afford to pay for spirit for our men to drink, or for them to sell, and we are glad to have the Excise on the spot to see that things are all right. At the same time, if the Excise officers were not there, I hardly think we should employ a permanent staff to take their place.

1350. Would not the employment of a permanent staff by you prevent that possibility to which you have referred?—Of course we have a good staff of our own who are efficient, and I think that they would be capable of seeing that no irregularities were carried out. At the same time we are very glad to have the assistance of the Excise officers.

1351. Put it in another way. Supposing, as you stated, that your own supervision would be of such a character as to prevent a man making illicit and immoral use of the spirit, yet the casual unpremeditated visit of an officer daily, but at no stated time, would be enough for the purposes of stocktaking and general supervisison without regard to this particular question of drinking the alcohol. I take it that the only time when they could drink it would be just before you mix it with the camphor in the bonded room?—I should think it would. I should think it is a matter of opinion whether a spirit of that sort would be drinkable. I suppose it is; but we have never had it done.

Mr. C. P. Merriam.
23 Nov. 1904.

1352. Your men assist the officers I presume, and the officers simply supervise the operation of removing the spirit from the store and mixing it ?—Yes. The store itself cannot be entered without the Excise officer's key as well as our own, and in the mixing-room, an Excise officer is constantly present when anything is going on. There is one chief officer, and he has two assistants, and somebody is on duty at the time when we are at work—very often two of them are.

1353. Perambulating the whole place ?—No. They have a perfect right to go over the whole place if they like. Of course, after it has been mixed with the pyroxylin it is of no importance to them, and so there are not more than three or four rooms in the factory where the Excise officers work.

1354. Does the form of denaturing which you have adopted completely answer your purpose ?—We are quite satisfied with it.

1355. It would be an additional precaution if the spirit to which the camphor is added was also coloured, would it not, but then I presume, that would interfere with one or two of your subsequent operations ?—I should not like that at all. Any colouring at all we should consider an impurity which would have its effect upon our manufacture.

1356. Would it be possible, in view of that fact, to, as it were, have different tanks in which different colours could be added to separate portions of the spirit ?—I am afraid that would not be practicable, because the number of colours and of shades is very great.

1357. What is at the back of my mind is this. I want to reduce supervision to a minimum in my own mind if I possibly can, and to put the spirit into such a condition that a man would have a horror of it, as he generally has under certain conditions ; if brandy, for instance, was green do you think he would drink it ?—We do not want the supervision reduced. We are quite happy with the supervision, but we feel that the £400 a year is rather a heavy amount to pay for it. Certainly our foreign competitors do not have to pay it. We do not ask that the supervision should be lessened at all, and we are quite content with the supervision. It is not at all too stringent for us ; in fact, the more stringent it is the better we like it.

1358. It helps you certainly as regards your men ?—Yes.

See Q. 1342-6

1359. (*Mr. Nicholson.*) You mentioned that you were offered some spirits at 4½d. per proof gallon a year or two ago ?—Yes, that was an approximate figure, it might have been 4⅝d.

1360. Did you buy it ?—No.

1361. May I ask why ?—Because at that time we had not permission to use pure spirit.

1362. It might have been used as methylated spirit, might it not ?—We had no methylating license. We were not methylators.

1363. Might it not have been done in conjunction with the methylator ?—I have no doubt the methylators who supplied us did buy it at that figure.

1364. And you bought your methylated spirit correspondingly cheaper ?—No, we did not get the advantage, but that was an accident. That was because there was at that time I think, a ring of methylated spirit-makers, which may exist now for all I know. At the time the pure spirit was coming so cheaply from Germany we had no advantage from the methylated spirit maker.

1365. Is the spirit that you use all dissipated, or do you recover any in your manufacture ?—We do not recover any. Most of it passes away in the seasoning, but there is, I think, a very slight percentage remaining.

1366. Do you as a fact find that there is any leakage through theft on the part of your workmen ?—We have never found it so. I think there was a case, perhaps 25 years ago, when we found men were taking the methylated spirit, but I do not think we have had a case since—at any rate not to our knowledge.

1367. I think you said that you do export to Germany even ?—Yes.

1368. You are aware that in Germany industrial spirit is State-aided ?—Yes ; I suppose it is.

Export trade in xylonite. Competition in Germany just possible. *See also* Q. 1315-6

1369. And yet you can compete in spite of that ?—We can compete with difficulty. I am bound to say that we know the profits that are made by our competitors, and we know that they are much greater than ours as the figures are published, so we know what they are.

1370. Is the quantity you export any large proportion of your output ?—Are you speaking of our general export, or are you particularly referring to Germany ?

1371. I am referring to your general export ?—I cannot give you the figures offhand, but it is a perceptible amount —it is a good proportion of our total manufacture.

1372. Sufficient to influence your profits considerably ? —It all helps, of course. When we are exporting to a country where celluloid manufacture is carried on our profit is very small, and we can with difficulty compete.

1373. What I was coming to was this. Supposing the Tariff Act of 1876 was in force, would you have no cause of complaint then ?—If the Tariff Act of 1876 was in force we should be in a very fortunate position ; there is no doubt about that.

1374. You are aware that the differential duty is a condition precedent to the existence of the English distiller, and that without that differential duty he could not exist against his foreign competitors ?—I did not know that, but I have never asked to have it taken off.

Rebate on industrial alcohol suggested.

1375. You may take it that that is so. As I understand your suggestion in putting forward this grievance it was that there should be some rebate in the case of spirit used industrially as you use it ?—Yes ; I have never attempted to suggest that the differential duty should be taken taken off.

1376. That would be contrary to your views ?—I do not express an opinion about that. What we have done has been to take the law as we found it, to point out that a remedy existed for people in exactly our case, and ask that the Government should carry out the law. That is our entire position in the matter.

FIFTH DAY.

Tuesday, 29th November, 1904.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair*).

Professor Sir WILLIAM CROOKES, F.R.S.
Mr. LOTHIAN D. NICHOLSON.
Dr. W. SOMERVILLE.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*).

Professor RAPHAEL MELDOLA, called; and Examined.

Prof. R. Meldola.

29 Nov. 1904.

1377. (*Chairman.*) The Committee understand that you were connected with the coal tar colour industry in past times?—Yes, I was.

1378. At what date?—My first connection with the industry was in the year 1870. I then spent two years in a chemical factory—a colour factory, at Brentford. Then I had a little interval, and in 1877 I again entered a colour factory, the Atlas works, belonging to Messrs. Brooke, Simpson & Spiller; and there I worked till 1885, when I left the industry to take my present appointment.

1379. Your present appointment being—— ?—Professor of Chemistry in the Finsbury Technical College of the City and Guilds of London Institute.

1380. While you were connected with the Atlas Works were you a partner in the firm, or were you merely employed as a chemist?—I was employed as a scientific chemist.

1381. Since you left the Atlas Works in 1885, as I understand you have not been connected in a business way with this industry?—Not strictly speaking in a business way. I was retained for three years as a kind of external adviser to the firm after I left in 1885; but I had very little to do with them really.

1382. But I suppose you have kept yourself to a certain extent in touch with the progress of the industry since that date?—Yes, I have kept careful notes of the various discoveries in connection with the industry which have been made here and abroad during that period.

Aniline Dye Industry, 1870 to 1885. Use of Methylated Spirit as a solvent and methyl alcohol (wood naptha) for making methyl iodide.

1383. During that period, 1870-1885, during which you were connected with the industry, was alcohol largely used in the works?—For certain colours large quantities of methylated spirit were used as a solvent, and for two other colours methylated alcohol was used without introducing the alcohol radical itself into the colouring matter.

1384. Which were those two?—Those two were Hofmann's violet and iodine green, which was really a by-product in the manufacture of the Hofmann violet.

1385. In what form was alcohol used for that purpose?—We used wood naphtha.

1386. Not purified?—Not purified.

1387. And not paying duty?—I believe not.

1388. Was that quite satisfactory?—It was for that purpose. It was really converted into methyl iodide.

1389. Before being used?—Before being applied to the production of the colour.

1390. For the other purpose, as a solvent, was the ordinary methylated spirit quite satisfactory?—Yes, it was quite satisfactory; and, of course, it was recovered after the operation with the usual small amount of working loss. It did not enter at all into the composition of the final product.

1391. Was the recovered spirit largely purified?—No, it was just used as it came over from the stills; it was used over again for the same purpose.

1392. As it came over from the stills it was considerably purer than it was in its original form of methylated spirit, was it not?—I should not like to say that. I think that volatile impurities may have come over with it. They had no effect, however, upon the subsequent operations.

Dyestuffs prepared in England and abroad respectively. (1870 to 1885)

1393. During that period were there other dyestuffs that were not manufactured in this country, and that that were brought from abroad?—During the period 1870-1885 there were many new colouring matters discovered abroad. I have prepared two lists for the use of the Committee, one showing the dye stuffs which were being manufactured in this country during that period, 1870-1885, and another showing the colouring matters which were discovered and made abroad during the same period, it being understood of course that the foreigners were also making most of the same colouring matters that we were making here at that time; so that the foreign list is really the British list plus their own discoveries. (*See* Question 1442. For convenience of reference the lists are printed here as a footnote.*)

1394. But the British manufacturer had the market here pretty well for his manufactures of the colours in the first list?—He had the market very much in his hands down to about the year 1880; I take it that that is about the period when we first began to notice perceptibly a decline in the industry in this country.

Of fourteen typical colours produced in England three required alcohol—one of them, the most important of all, and sold at a large profit in solution with methylated spirit.

1395. In regard to these dyestuffs that were made only abroad, I presume it was not open to our manufacturers to make them, because they were patented?—That is so, except, I believe, in one case, where the foreign patent had lapsed. That is the colouring matter which is entered as No. 1 on the foreign list, methyl violet, I believe the patent for methyl violet lapsed some time during that interval, because that colour was made in this country.

1396. Amongst the dye stuffs that were manufactured here, numbering fourteen on your first list, were there any which did not require alcohol either as a constituent or as a solvent?—Yes, a very large number of them did not. In fact, there were only three colours on that list which required alcohol at all, those three being No. 2, aniline blue, which requires alcohol as a solvent for purification, and Nos. 3 and 4 (Hofmann's violet and iodine green)

* Dyestuffs manufactured in the United Kingdom during the period 1870-1885:—

(1) Magenta or rosaniline.
(2) Aniline blue and its sulpho-acids.
(3) Hofmann violets.
(4) Iodine green.
(5) Manchester or Bismarck brown.
(6) Aniline yellow.
(7) Indulines.
(8) Phosphine.
(9) Safranine.
(10) Chrysoidine.
(11) Naphthol orange and other azo-colours.
(12) Picric acid.
(13) Manchester yellow.
(14) Alizarine.

Dyestuffs made abroad during this period:—

(1) Methyl violet, crystal violet, etc.
(2) Methylene blue.
(3) Acid magenta.
(4) Malachite green, brilliant green, Victoria blue, night blue, Auramine, etc.
(5) Group of mono-azo colours from homologues of aniline and sulpho-acids of naphthols.
(6) Disazo-colours of various kinds and of special importance the direct cotton dyes.
(7) Oxazines, such as gallocyanine, etc.
(8) Phthaleins, such as eosin and related dyes.

Prof. R. Meldola.

29 Nov. 1904.

which, as I have already explained, require methyl alcohol for methyl iodide.

1397. The others you say required no alcohol at all ?—That is so.

1398. Could you say at all what sort of proportion the three colours that required alcohol bore to the total products of the works;—I am afraid I could not give you actual numerical data, because I was not connected with the purely commercial side of the concern, and I have no notes. Speaking generally from my recollection of the period I should say that the Hofmann violets did not bear a very considerable proportion to the whole output, but at one time they were very valuable and fetched very high prices. The quantity of iodine green was always quite insignificant, and I think really, as a serious item of British industry, it may be put out of consideration altogether; there was never enough of it made or sold to make it worth considering seriously. With regard to the aniline blue, that was far and away the most important of the colouring matters made during that period by the firms with which I was connected.

1399. Taking the aniline blue, the margin of profit in those days, that is between 1870 and 1880 say, was large, was it not ?—It was very large indeed during that period. I may add in connection with that, that the cost of the spirit was really considered as of no account by the dyers themselves, because one form of that blue was sold in alcoholic solution, and was thrown in that form into the dye vat, and was lost altogether so far as the alcohol was concerned.

1400. The alcohol which held it in solution was the ordinary methylated spirit, I presume ?—Yes.

1401. And that had no injurous effect upon the colour ?—No, not when it was used in that form for that particular purpose as a solvent.

Colours made abroad. Manufacture in England not prevented by hindrances to use of alcohol, but because discovered and patented abroad, or made by processes not understood here.

1402. Taking your second list, which contains eight groups of colours that were manufactured abroad during 1870-1885, would you tell us whether alcohol entered into all of those ?—It did not enter into all of those by any means. I am prepared, if you wish it, to specify those which required alcohol.

1403. I do not know that it is necessary to go into it in great detail. What I rather wanted to get from you is this: Was the alcohol in respect of these eight groups of colours a greater necessity than it was in respect of the fourteen colours that were manufactured in this country during that same period ?—So far as concerns those colours on the foreign list which contain alcohol radicals as a constituent part of the dye stuff, the alcohol in that case being a chemical constituent of the colouring matter, was certainly of very considerable importance.

1404. Do you suppose that in order to get that chemical constituent it was necessary to use pure alcohol ?—For some of those colouring matters particularly for No. 1, (methyl violet, crystal violet, etc.,) No 2, (methylene blue), and No. 4 (malachite green, brilliant green, victoria blue, night blue, auramine etc.) the use of dimethylaniline was required, but that had to be prepared by the use of pure methyl alcohol when that process was dependent upon the use of methyl alcohol. During that period when I was connected with the industry two methods of making dimethylaniline were in use. One of them depended upon the utilisation of a waste product of the beet sugar industry. From that they obtained methyl chloride, by means of which they made dimethylaniline. That process was carried on in France during the period to which I am referring.

1405. However that may be, manufacturers in this country were precluded by quite other things from themselves making these colours, quite apart from the question of alcohol ?—Quite apart from that.

1406. In other words, they were precluded from making them by the fact that these dye stuffs in your foreign list had been discovered abroad and patented abroad ?—That is so. I may add, furthermore, that even supposing they had undertaken to make these colours here by paying royalty to the inventors, the question of the price of the alcohol would not have deterred them at all, because the margin of profit was so great that they could have borne the use of a dutiable spirit at that time

1407. They could even have paid the duty ?—I believe so. The question of the cost of alcohol was never raised in my period. We went into this question with regard to many of these colouring matters, as to whether it would be worth while to take them up, and in the case of No. 8 (the phthaleins) we had experiments made in our factory to see whether it would pay to take them up, even paying the price for ether (at the then market price), which was then used as one of the solvents. We found that even at that price for ether we could have made eosin, for example, with a very considerable margin of profit. As a matter of fact, it was not made during my period, but that was not for any reason connected with the cost of the ether.

Eosin an instance. (*See also* Q. 1435-7.)

1408. Do you recall what the reason was ?—There were several reasons. In the first place, one of the raw materials for making eosin was a substance known as resorcin, and the manufacture of that at every stage of the process requires quite a specially constructed plant and experience in working it, which we had not in this country. The foreigners had been making these colours for some years, and had put up the necessary plant, and had acquired the necessary experience. That is as regards the resorcin, which is a substance which requires ether for extracting it from the solution. But then there is another raw material used in the manufacture of these colouring matters which is called phthalic acid. At the time when we investigated these dyestuffs it was not known to the manufacturers in this country what was exactly the precise process which the foreigners were using for making phthalic acid; and when we worked out the process, as I explained, in order to find out whether it would pay to make these colouring matters or not, we based our calculations on the price of phthalic acid as bought already made from the Continental manufacturers. We did not know how to make this intermediate product sufficiently cheaply. In the manufacture of phthalic acid alcohol was not used at all.

None of English made colours required pure alcohol.

1409. In connection with the colours that were made in this country during 1870 and 1885 did you use any duty-paid pure alcohol ?—No, none of the 14 colouring matters on the home list require pure spirit, either methyl alcohol or ethyl alcohol. The use of pure methyl alcohol came in, as I explained, with those colouring matters which were made from dimethylaniline, and when we made methyl violet we bought the dimethylaniline already made from abroad.

Present conditions of aniline dye industry. Cheap alcohol a necessity. (*See also* Q. 1417 and 1422-3.)

1410. Taking the industry as it is now, should you say that the use of pure spirit is more necessary than it was at that time ?—Yes, I should say that the conditions have completely changed during the 19 or 20 years since I left the industry.

1411. So that, whatever was the case up to 1885, now in this present year it would be necessary to the success of the industry to have absolutely pure spirit, and to have it pretty cheap ?—Yes. I think I may state that I base the conclusions that I have arrived at on the consideration that the margin of profit is now very much smaller than it was during my connection with the industry. Therefore, in any raw material requiring the use of methyl or ethyl alcohol, the proportional cost of the spirit as compared with the selling price of the subtsance is now quite different. Formerly we had large margins of profit, and we could neglect the few pence per pound difference between duty-paid spirit and duty-free spirit. But now the margin of profit is very much smaller, and competition has become keener, and therefore a few pence per pound difference may make all the difference in the success or failure of the industry. So that I am distinctly of opinion now that the time has arrived when it would be advantageous for manufacturers to have duty-free spirit.

Decadence of British dye industry not confined to the part requiring alcohol.

1412. According to your evidence, up to the present date we have lost quite as much, if not more, of the industry which requires no alcohol, as we have of that part of the industry which does require alcohol ?—Yes, that is so. That comes out very clearly by comparing these two lists. I would particularly call your attention to No. 14 (alizarin) on the home list. That is by far—or at least, it was by far—the most important of the artificial colouring matters. At one time we were manufacturing that in this country, and then we lost the whole industry for many years; it is being restored now. That is an instructive case from this point of view, because no alcohol is used at all at any stage of the process.

1413. And never has been ?—And never has been.

Alizarine an instance.

1414. Taking that as an illustration, to what would you attribute the fact that we lost what was a flourishing trade in that particular colouring matter, alizarine?—I am afraid I could not give a very satisfactory reply to that question beyond again asserting that it cannot possibly have had anything to do with alcohol at all. I think it is very probable that there may have been some collusion between the foreign manufacturers to keep prices down. It may have been more a fiscal question than a chemical question. It certainly had nothing whatever to do with alcohol.

1415. That particular branch of the manufacture is being re-established in this country, you say?—Yes, it is.

1416. Do you know whether to any great extent?—Yes; I am told that they have made very considerable progress of late years in restoring it.

Importance of cheap alcohol at present time. (*See* also Q. 1410 and 1422-3.)

1417. You say, towards the end of your *précis*, that under the new conditions of the industry the relative cost of the alcohol is a much more serious consideration than it was before. Of course, if you take the difference in cost between duty-free alcohol and duty-paid alcohol, there is a very wide margin; should you say that the conditions of the industry are such that a difference of, say, a small amount—not the whole of the duty, but a difference of 6d. per gallon—would make a serious difference in the likelihood of commercial success in this country?—Yes. I should be disposed to think that it might make—I will not say a serious difference—but it might make some difference. In these days, when the competition is so keen and the margin of profit is so very much reduced, even a small difference may tell very much against our manufacturers.

1418. Now, going to the interests of the modern manufacturers other than those connected with the colour industry, can you suggest to the Committee any other directions in which alcohol is of importance?—I did not come here quite prepared to speak on other industries. I have had very little actual connection with any branch of chemical industry requiring the use of alcohol except the coal tar colour industry; but I can imagine that there are industries, such as, for example, the perfume industry, which does also require alcohol.

1419. But you have no special knowledge of it?—I have no special knowledge of any organic chemical industry requiring the use of alcohol except the coal tar colour industry; but, as I say, I have no doubt there are many industries, such as the perfume industry and the manufacture of certain pharmaceutical preparations, in which the use of alcohol is absolutely essential either as a solvent or for the preparation of some of the compounds.

Industries requiring alcohol; their decadence in United Kingdom due primarily to lack of scientific spirit in British manufacturers. (*See* also Q. 1466.)

1420. (*Mr. Tyrer.*) It has been said that the decadence of the industries of the country requiring alcohol, particularly the colour industries and the manufacture of other organic chemicals, has been due to other causes than that of the necessity to use duty-paid alcohol, such as the patent laws and the fitness of our educational standard for the supply of chemists. We have had that stated pretty clearly here, and it would therefore be interesting to know your opinion on both those points?—I will deal with them separately, if I may. With regard to the question of education, my own view is that the decadence of the coal tar colour industry is primarily due—I suppose one may call it—to the lack of education, or, to put it in another way, to the lack of appreciation of chemical science by our manufacturers. If you will notice, all these newer inventions come from abroad, and I certainly cannot for a moment imagine that anyone would say the foreigner has discovered these things because he had duty-free spirit—I do not think that has anything to do with it at all. It is because manufacturers abroad appreciated chemical science and availed themselves of every discovery (either in their own laboratories or in the laboratories of Universities or technical schools, or wherever research work was being carried out) that was likely to turn out of practical use; whereas our manufacturers have neglected that side of the subject. Therefore, all these newer discoveries have come from abroad. That, I think, answers the question so far as concerns education. So far as concerns the patent laws, is that really within the scope of your inquiry?

Patent laws a subordinate factor.

1421. We have asked the question of others, and it is interesting to see how persons like yourself, who have to look very practically and candidly at these matters, feel with regard to that?—My feeling with regard to that is pretty much the same as it is with regard to the question of education. I do not suppose for a moment that these things were discovered because of the foreign patent laws; but I am prepared to admit that, having discovered these things by scientific research and made use of them industrially, then the foreign patent laws did help them and were, so far, to the detriment of our own manufacturers, who were thus not able to make these things. That puts the patent difficulty in a subordinate position, because the primary thing is the discovery—the invention. If we had discovered these things here, if our manufacturers had availed themelves of scientific resources, the spirit question and the patent law question would have been raised more than a quarter of a century ago.

Present importance of alcohol. (*See* also Q. 1410 and 1417.)

1422. Then practically it comes to this—that, other things being equal, the question of the cost of the alcohol would have been of primary importance instead of taking a second place, so to speak? To put it in another way—supposing for the moment that the discoveries were made either in part or to the same degree in this country, then you would admit, of course, that the difference in the cost of alcohol, having regard to the narrow margin of prices, would be now, and at all times in fact, a great inconvenience and hindrance?—I can hardly admit that, going back in time. I do not admit that the alcohol question would have been of no importance if we had discovered these things between the period, say, of 1870 and 1880; but down to that period the margin of profit was sufficiently large to push the alcohol question altogether into the background. It is only in later times, when the margin of profit has fallen, that the alcohol question has become of more pressing importance.

1423. Therefore, assuming the educational standard of the research chemists to be raised and a period to come in which the opportunities are in that respect equal, then the alcohol question would assume a corresponding importance; in other words, it would be necessary for us to be as nearly as possible equal, if not in every respect equal, in cheapness and other conditions to our foreign friends?—That, I take it, is the state of affairs that we have reached now, and I have already expressed full concurrence with you on that point.

Necessity for better appreciation of chemical research in British manufacturers. (*See also* Q. 1444.)

1424. (*Sir William Crookes.*) Take your second group—the foreign group: To discover bodies like those requires very high-class chemical knowledge and education and men accustomed to research, does it not?—Yes.

1425. Had we in England sufficient research chemists who were competent to make these discoveries?—They could have been obtained if required.

1426. Do you say that our chemical education was up to that point?—I do not know that it was here, but many of our young men were being trained in Germany.

1427. I mean, had we sufficient English-trained research chemists?—I doubt whether at that period you could have got properly trained organic chemists from the English schools.

1428. So, at the time when the Germans were making these discoveries and taking out these patents, they had much more highly-trained research chemists than we had in England?—That is so in this particular line.

1429. Manufacturers in England were not at all alive, then, were they, to the necessity for highly-trained research chemists?—No. I consider that as *the* chief cause of our decadence. They allowed the foreigners to get the start in the way of discovery.

1430. Would you say that if manufacturers had been alive to the necessity of employing research chemists the demand for these chemists would very soon have been filled up from the laboratories in England?—Yes.

1431. You will admit—and there is no doubt about it—that they were simply not produced because there was no demand?—I admit that. It is another case of the reaction between supply and demand.

1432. It seems to me—I do not know whether you will agree—that the first thing required is to educate the manufacturers?—It certainly was so in my time.

Prof. R. Meldola.
29 Nov. 1904.

1433. And to get them to see the necessity for highly-trained scientific knowledge?—I thoroughly agree with you on that point. I think an appeal to the results shown in these two lists should, if anything, open their eyes.

1434. (*Mr. Tyrer.*) With regard to the methyl violet I understood you to say that in some cases alcohol was not necessary but dimethylaniline was. So far as that was produced from wood naphtha, was that purified wood naphtha or the ordinary crude stuff?—We never made dimethylaniline here. We purchased it. There is an important point in connection with that. Of course, it may be asked why we did not make it here, and whether the price of pure methyl alcohol was prohibitive. In answer to that I may point out, as I have already said, that there was another process in use which did not require methyl alcohol at all and which brought down the price of dimethylaniline very considerably. Then with regard to the process which did require the use of methyl alcohol, there again the foreigners had taken the lead. That branch of manufacture required a very special kind of pressure pot, known technically as an autoclave, which is an iron vessel enamelled inside, capable of standing a high temperature and very great pressure. At that time none of our manufacturers here had ever turned out anything under those conditions; they were quite inexperienced in the use of the plant, and the plant itself could not be got here. We did at one time contemplate making dimethylaniline—quite apart from any consideration as to the cost of the methyl alcohol; and I myself was commissioned to go over to France to see about it. I found that we should have to sink a very considerable amount of capital in buying these autoclaves, and that at the then price of dimethylaniline it would not have paid to do it. I do not think the spirit question had anything to do with our failing to make dimethylaniline for methyl violet. We found it pay sufficiently well to import the dimethylaniline ready made and convert it into the colouring matter here.

(*See* Q. 1404.) Reasons for importing, and not making, dimethyl-aniline were not connected with alcohol question.

1435. Then the same observation will apply as regards cheapness, or its hindrance in that respect, to ether being permitted to be made from methylated spirit; that would of course be reduced comparatively in price, but it would not be as cheap as the foreign ether. Do you recollect whether at that time, up to 1885, the foreign ether was as dear as English methylated ether?—I have no recollection of that point, because we never used ether at all for any of our operations.

Ether in making dyes. First required for phthalein group (1874 to 1882), now obsolete. (*See* also Q. 1407-8).

1436. When did the Germans begin making these modifications and rebates, do you know?—I can tell you when the phthaleins were first introduced—and those were the first colouring matters that required ether on a large scale as a solvent. They were introduced between 1874 and 1882. In 1874 there was the first introduction of the eosin group and then ether was required on a large scale for making resorcin.

1437. That is still a valuable material, is it not?—No. the phthaleins of that group have practically been displaced now by the rhodamines, their successors, which do not require ether at all.

1438. (*Mr. Nicholson.*) Although the circumstances are rather peculiar at the present moment with reference to the price of alcohol, speaking generally, are you aware that spirit in Germany for industrial purposes is cheaper than it is in England?—At the present time, yes it is; and it always has been, I suppose.

Price of spirit. Reduction by a few pence would be a real benefit.

1439. Owing to its being State-aided?—Do you mean as distinguished from duty?

1440. As a portion of the duty?—Yes; I am aware of that.

1441. Still, supposing spirit cannot be obtained in this country as cheaply as abroad, on that account it would be a great help if it could be cheapened by even a few pence?—Yes, I am distinctly of that opinion.

1442. (*Dr. Thorpe.*) I presume you would desire that these lists to which you have made reference should be handed in, and should be incorporated in your evidence?—Yes. Further, I may state that I have written out a short history of the coal tar industry between 1870 and 1885, which I will hand in. (See page 59.) The following are the lists that I have been referring to: Dye-stuffs manufactured in this country during 1870-1885: (1) Magenta or rosaniline; (2) Aniline blue and its sulpho-acids; (3) Hofmann violets; (4) Iodine green; (5) Manchester or Bismarck brown; (6) Aniline yellow; (7) Indulines; (8) Phosphine; (9) Safranine (10) Chrysoidine; (11) Naphthol orange and other azo-colours; (12) Picric acid; (13) Manchester yellow; (14) Alizarin. Dye-stuffs made abroad during the same period:—(1) Methyl violet, crystal violet, etc.; (2) Methylene blue; (3) Acid magenta; (4) Malachite green, Brilliant green, Victoria blue, Night blue, auramine, etc.; (5) Group of Mono-azo-colours from homologues of aniline and sulpho-acids of naphthols; (6) Disazo-colours of various kinds and, of special importance, the direct cotton dyes; (7) Oxazines such as gallocyanine, etc.; (8) Phthaleins such as eosin and related dyes.

Lists of dye stuffs. (*See* Q. 1393-1409).

1443. May we take it that your position as Professor of Chemistry in the Finsbury Technical College has occasioned you to keep up your interest in this particular subject?—Yes, I follow the developments in the colour industry and in organic chemical industries generally.

1444. With respect to an observation which was let fall by Mr. Tyrer, namely, that the educational standard of research chemists required to be raised in this country, it is not so much, I gather, the educational standard of the research chemists which requires to be raised as it is the appreciation of the work which these men do which requires to be raised?—I think Sir William Crookes has said that it is really the educational standard of the manufacturers which requires raising. The chemists can be found if the manufacturers will avail themselves of their services.

Lack of scientific spirit in manufacturers. (*See* Qs. 1424-1433.

1445. Over and beyond that, is it not the fact that it is only within comparatively recent years that that attention to systematic organic chemistry has been given in our educational institutions that the importance of the subject demands?—Yes, if we rule out that period during which Hofmann was here. I think that during Dr. Hofmann's sojourn in this country he really was a kind of centre of activity for organic chemical research. No doubt the work done in the old College of Chemistry in Oxford Street had very considerable influence upon the industry in this country. But it is quite proved, as you have said, that in later times there was a very considerable lapse in that respect; and it is only in still more recent times that organic chemistry has become more systematically incorporated into our educational systems.

Systematic education in organic chemistry of recent date only in United Kingdom.

1446. Prior to that time of course our teachers were mainly concerned with inorganic and physical chemistry?—That is so.

1447. And their teaching therefore reacted upon the industries in which their students, who had been brought up so to say with that kind of chemistry, could alone find employment?—That is so.

1448. Have you any reason to think that, assuming that the manufacturers of this country were put into the same position as their French and German competitors in regard to the use of alcohol, there is any reasonable expectation that this industry, or any very large portion of it, would come back to us?—That is a very difficult question, because if I answer it, as I feel bound to do, in strict accordance with my own conclusions, it might appear that I am taking a very pessimistic view of the situation. But being asked the question directly at this table I feel bound to state that in my own opinion we have lost way to such an enormous extent that the outlook is very hopeless for that industry.

Doubtful prospects of revival in British aniline dye industry even with duty-free alcohol, except in regard to new discoveries.

1449. (*Chairman.*) For that particular industry?—Yes; I think Dr. Thorpe's question referred specially to that industry.

1450. (*Dr. Thorpe.*) I am really thinking of the industry which has departed from us subsequent to 1880. Even if the concession of duty-free alcohol were given, is there any reasonable expectation that we should ever recover it?—I am afraid not.

1451. (*Sir William Crookes.*) You mean for the dyes and such things as are at present being manufactured?—Yes.

1452. But the progress of science must go on, and something new will be discovered. Imagine something new in this line being discovered in England; have we now sufficient talent and material resources to hold our

own against foreign competition in anything in this class of goods which might be new?—Supposing we were to discover something new here that required the use of alcohol in some form, then I distinctly say that unless we were put on the same footing as the foreigner we could not possibly compete at the present time. But my general opinion is that the chances of finding anything new are very small in this country, on account of the enormous odds against us. Taking the whole of our colour factories in this country, you will find that the scientific strength, that is to say, the number of research chemists actually employed in them, is quite a negligible quantity. In Germany to-day you will find a hundred research chemists in the service of one firm only; and there are some twenty odd colour factories going full speed in Germany. That is why I consider the outlook here is such a hopeless one.

Chemical research in German works—its wide range and far-reaching results in developing new branches of industry.

1453. (*Chairman.*) Those research chemists that they employ in these factories in Germany do not confine their attention solely to the particular subject of that industry, do they?—All the chemists, for instance, employed in a German colour factory are always making researches more or less in connection with the products which their factory is turning out—that is, of course, either the products or the raw materials; in fact they are on the look out for new marketable products.

1454. (*Dr. Thorpe.*) What the Chairman means is that they are not on the look out solely for products which are necessarily to be turned into dyes?—No, certainly not, but which can be turned into something marketable.

1455. (*Mr. Tyrer.*) Such as the synthetic pharmaceutical products for instance?—That is true. Out of the colour industries have arisen many other branches of organic chemical industry.

1456. (*Dr. Thorpe.*) It is a fact, is it not, that the *Badische Anilin und Soda Fabrik* make a great many other things than dyes?—Certainly.

1457. For instance they make photographic chemicals?—Yes, they make photographic chemicals; and some of the colour factories have turned their attention to synthetic perfumes and pharmaceutical preparations.

1458. (*Chairman.*) In fact the labours of these research chemists may result in suggestions for entirely new industries?—Yes, entirely. I might mention, for example, that the discovery of the synthesis of indigo, and the working out of that process by the Badische Company, has led to a revision in the processes for making sulphuric acid.

Prof. R. Meldola.
29 Nov. 1904.

1459. (*Dr. Thorpe.*) Is it not also the fact that some of the large firms like Meister, Lucius and Brüning have actually been turning their attention to the manufacture of enzymes and ferments and other matters connected with, or the outcome of, modern bacteriological inquiry, which has resulted in practical application?—That is so; and of anti-toxins.

1460. These are being made by chemical manufacturers who formerly solely made colouring matters?—That is so.

1461. (*Dr. Somerville.*) I will just ask you if this firm of Meister, Lucius & Brüning are concerned with the manufacture of aniline colours as well as with these ferments?—Yes, and they were one of the largest makers of alizarin at one time.

1462. Then, I suppose, it cannot be said that the production of ferments like mallein, nitragin, and so on have any sort of connection with the colour manufacture?—They have no direct connection with it.

1463. That is to say, they have not, at any rate, emerged from the colouring industry, but they have been grafted on to this particular firm, more or less, one might almost say as a matter of chance.

1464. (*Dr. Thorpe.*) Except that they have skilled men who have turned their attention to these things, and the firm has turned their discoveries to marketable account?—That is true historically.

1465. (*Mr. Tyrer.*) If the patent laws were amended in the direction which has been desired by so many, so that every patent taken out in this country by a foreign inventor must be worked here, would that not assist materially in the development of home industry?—It would give employment to people in this country.

1466. Of course, so far as alcohol is a necessity, in order that they might work on something like equal terms, would not the alcohol require to be as nearly as possible at the same price; in other words, should not all the conditions, skill as well as everything else, be the same?—Yes; I have already said that, as regards the present state of affairs. I may state that the general drift of my evidence as far as I wish to give it to this Committee, is simply to try and remove the erroneous impression which has got abroad that we have lost the coal-tar colour industry on account of the cost of the spirit. That is a statement from which I feel bound to express complete dissent.

Cost of spirit has not been the cause of losing coal-tar colour industry. *See* Q. 1420, etc.

STATEMENT HANDED IN BY PROFESSOR MELDOLA.

History of the Coal-tar Colour Industry between 1870 and 1885.

I will preface this short history with the statement that I propose to confine my remarks entirely to that branch of manufacture with which I have been practically associated, viz., the coal-tar colour industry, my first connection with which was in 1870–72 in some works at Brentford which are now no longer in existence. In 1877 I again entered a colour factory, the Atlas Works at Hackney Wick, belonging to the firm of Brooke, Simpson & Spiller, the successors of Simpson, Maule and Nicholson. I was scientific chemist to the former firm for eight years so that for more than ten years altogether I was actually engaged in the laboratories of colour factories, and I can claim to have been in intimate touch with the industry here and abroad during the fifteen years between 1870 and 1885, when I left the Atlas Works to take up the duties of my present appointment. My evidence relates only to the period referred to, during which the chief colouring matters made in this country were:—

(1) Magenta or rosaniline; (2) Aniline blue and its sulpho acids and by-products; (3) Hofmann violets; (4) Iodine green; (5) Manchester or Bismarck brown; (6) Aniline yellow; (7) Indulines; (8) Phosphine, a by-product of the magenta manufacture; (9) Safranine to a limited extent; (10) Chrysoidine; (11) Naphthol orange and other azo-dyes; (12) Picric acid; (13) Manchester yellow; (14) Alizarine.

During the same period there were discovered and manufactured abroad in addition to the above colouring-matters (France and Germany):—

(1) Methyl violet, Crystal violet, etc.; (2) Methylene blue; (3) Acid magenta; (4) Malachite green, Brilliant green, Victoria blue, Night blue, Auramine, etc.; (5) Group of mono-azo colours from homologues of aniline and sulpho-acids of naphthols; (6) Disazo-colours of various kinds and of special importance the direct cotton dyes; (7) Oxazines such as Gallocyanine, etc.; (8) Phthaleins such as Eosin and related dyes.

These lists comprise most of the dyestuffs of real commercial importance available for tinctorial purposes during the period covered by my experience. The decline in the coal-tar colour industry in this country began, as far as my memory serves, to set in manifestly about the year 1880. The causes leading to our decadence may have been and probably were at work earlier, but the results began to show themselves practically about the date referred to. In 1886 I read a paper on this industry before the Society of Arts in the preparation of which I asked for and obtained information from nearly all the chief dyers and printers in the country and I found, I may add to my own surprise, that even at that time about

Prof. R. Meldola.

29 Nov. 1904.

90 per cent. of the colouring matters we were using were of foreign manufacture.

I am informed that there are many manufacturers who attribute this loss of what was originally an English industry to the want of duty-free spirit, or that the want of such spirit has been at least one of the main factors of our decadence. My own experience combined with a consideration of the history of the industry during the fifteen years of my connection with it leads me to express dissent from this conclusion. The statement that the industry has been driven out of this country for the want of duty-free spirit, is in my belief, quite erroneous, because it can be shown that during the earlier years the question of the price of alcohol was quite a subordinate one. Our supremacy had in fact been lost long before the price of alcohol as compared with the prices of the finished products had become a matter of any great importance. I do not wish to imply that the cost of alcohol as a factor in determining the cost price of dyestuffs could be left out of consideration altogether, but the further back we go into the history of the industry the less important does the price of alcohol become. It is perhaps fair to say that during the period anterior to 1870 it was practically negligible and that during the period 1870–1880, when the decadence had set in, it was of quite minor consideration—certainly the relative cost of alcohol at that period does not warrant the belief that our loss of the manufacture had anything to do with the spirit duties.

This conclusion is based on the evidence furnished by the foregoing lists. Beginning with the fourteen colouring matters on what I propose to call the home list. I may in the first place point out that Hofmann violet and iodine green (Nos. 3 and 4) are the only dyestuffs into the composition of which the alcohol radicle—in this case methyl—enters as a component part. These dyestuffs were made from rosaniline base (No. 1) and methyl iodide, the latter being made from methyl alcohol. In my time the methyl iodide was made from ordinary "wood naphtha" and was not, as far as my memory serves, subject to any duty, so that the cost of wood naphtha in this case does not really come under consideration. The demand for pure methyl alcohol did not arise till later and then in connection with some of the newer dyestuffs which had been discovered abroad. To this point I must return subsequently.

With the two exceptions above referred to none of the colouring matters on the list required alcohol in any quantity excepting aniline blue (No. 2) This colouring matter was, during the course of my experience, among the most important of all the dyestuffs made in this country. Large quantities of alcohol were used in its manufacture, but the spirit was required in this case simply as a solvent for purifying the product at a certain stage. Methylated spirit was employed and recovered with but little loss after the operation. I would particularly call attention to the fact that in the case of this, which was certainly the staple product of the coal-tar colour industry for many years, the cost of the methylated spirit did not require to be taken into consideration at all as the alcohol radicle does not enter into the composition of the dyestuff. The working loss of spirit due to the process of recovery was not very serious: it was a quite negligible quantity down to the period of decline setting in about 1880.

Since none of the other dyestuffs on the home list required alcohol, and since in the case of those products above referred to which did require the use of alcohol, the price of the latter was for all practical purposes a negligible quantity, the conclusion seems to be inevitable that if we lost our supremacy the spirit duty can have had nothing whatever to do with the matter. So far as concerns the manufacture of those colouring matters which did require the use of alcohol at that period the foreign factories were in no better position than ourselves with respect to such dyestuffs as Hofmann violet and aniline blue. The first of these lingered on till quite recently because certain dyers preferred it for particular purposes. It is now extinct. Aniline blue and its derivatives on the other hand are still important products but we have lost our supremacy and by far the largest proportion of these dyestuffs now on the market is of foreign manufacture.

We had lost ground therefore in a branch of manufacture which was supreme in this country at one period, and for which, although methyl and ethyl alcohols were required, no excuse for our decadence could possibly have been based on the plea that the spirit duties were to blame. In confirmation of this view I would particularly call attention to the case of alizarine (No. 14). This colouring matter was and is among the most important of the coal-tar products. One of the processes for manufacturing it was discovered by Dr. W. H. Perkin, the founder of the coal tar colour industry in this country. Alizarin was at one time manufactured by Perkin's firm and their successors and afterwards by the British Alizarin Company. Although the raw material, anthracene, is produced in large quantities in this country the manufacture of alizarin here became practically extinct for many years although it is now being restored. Whatever may have been the causes of our temporary decadence in this case, the success of our competitors cannot possibly be attributed to their command of duty free spirit because alcohol is not, and never was, used at any stage of the manufacture.

The consideration of the general question of the cause of our decadence in the coal-tar industry does not. I imagine, come within the scope of inquiry by this Committee, but the proximate causes, so far as these are concerned with the alcohol question, may be said to be in the first place the discovery of new colouring matters and processes by the foreign chemists, and in the second place, the improvement of the processes for manufacturing the products already in existence. So far as concerns this last method of attack, I do not think that the question of duty free spirit can be raised at all for the period 1870–1885. The consideration of the introduction of new dyestuffs is, however, of fundamental importance, and this brings me to the second list which I propose to speak of as the foreign list. With the exception of the Oxazines (No. 7) all these compounds were discovered by foreign chemists. With respect to No. 7, I may at once say that I myself discovered the first member of this group in 1879. It was not manufactured in this country till very many years after its discovery, and then not in the factory where it was first discovered. The manufacture was taken up in Germany, almost immediately after the announcement of the discovery. I am able to state from personal knowledge in this case that although one of the raw materials contains the radicle of methyl alcohol, the duty upon pure wood spirit had nothing to do with the transference of this colouring matter to the German factories.

Turning to the other products on the foreign list, the introduction of methyl violet (No. 1) in 1866 by the French firm of Poirrier first created a demand for a raw material, dimethylaniline, into the composition of which the radicle of methyl alcohol enters as a component part. Other important dyestuffs on the list, viz., Crystal violet (No. 1), Methylene blue (No. 2), Malachite green (No. 3), Victoria blue and Auramine (No. 4), also required the use of dimethylaniline. The dates of the introduction of these colouring matters are given below in chronological order:—

Methyl violet, 1866; Methylene blue, 1876; Malachite green, 1878; Crystal violet, Victoria blue and Auramine, 1883.

These colouring matters were the precursors of others of similar types into the composition of which the radicle of ethyl alcohol entered, such as brilliant green and night blue (1879 and 1883, respectively), which required diethylaniline. At the time, therefore, when the decline of the industry in this country had seriously set in, dimethyl and diethylaniline were being made abroad for the manufacture of new colouring matters which had been discovered by the foreign chemists. With the exception of methyl violet none of the dyestuffs on the foreign list were made in this country. Dimethylaniline was at that time by far the most important of the new raw materials called into existence by the discovery of those dyestuffs requiring its use. The effect of these newer colouring matters upon the dyestuffs being made here at the time of their introduction is evidently connected with the loss of our supremacy, and I propose to deal with this point now:—

The only two dyestuffs on the home list which may be said to have directly felt the effects of the new product were Hofmann violet and iodine green, the first of these being replaced gradually by methyl violet, and the second being rapidly and completely extinguished by the malachite green group. I may state at once that iodine green was produced only in very limited quantity, and that its loss cannot be said to have been a matter of any moment to British industry. The new blues, methylene blue, Victoria blue, etc., did not at first seriously interfere with

our aniline blue group, because they really fulfilled a different function in the tinctorial industry; they were applicable in a different way and to a different class of fabrics. They co-existed with the aniline blue group of dyestuffs and never displaced them altogether, since the latter are still in existence and rank high in the scale of importance. In 1880, therefore, when we were beginning to lose ground seriously, the only one of our dyestuffs directly affected by the introduction of dimethylaniline was Hofmann's violet. The question, therefore, now is—to what extent did the command of duty free methyl alcohol give our competitors an advantage in the manufacture of such dyestuffs as methyl violet, methylene blue, and malachite green?

In answer to this it may be pointed out in the first place that the new products were all foreign discoveries and patented by their discoverers. I cannot imagine that anybody will seriously maintain that these compounds were discovered *because* their discoverers had the use of duty-free alcohol. They could not have been made in this country without paying royalties or infringing the patents. When methyl violet was made here the patents had, I believe, lapsed. When it was made the dimethyl aniline was imported from abroad because no English manufacturer had at that time taken up its manufacture. I do not believe that our manufacturers were deterred because of the duty upon pure methyl alcohol. The question was never raised from that point of view down to the year 1880, and I am given to understand that when it did assume this form the Government were quite prepared to meet the wants of the manufacturer. In spite of this concession dimethylaniline, as far as I know, was never made in any quantity, if at all, in this country down to the time of my leaving the industry in 1885.

There are two processes for the manufacture of dimethylaniline, one consisting in heating aniline hydrochloride with methyl alcohol under pressure, and the other in acting upon aniline with methyl chloride. The latter substance was obtained about 1878 from a by-product of the beet-sugar manufacture, trimethylamine, so that this last process could never have been worked economically here. In the first process it is necessary, in order to get good results, to use *pure* methyl alcohol. According to my recollection it was certainly not the duty upon this product that deterred our manufacturers from taking up the dimethylaniline manufacture, but quite different considerations influenced their decision. The price of dimethylaniline was such that it would not have been worth while to make it here, the lowness of price being mainly due to the free use of methyl chloride, which was not made from methyl alcohol at all. The other process required the use of expensive apparatus ("autoclaves"), which would have had to be purchased abroad as there were no makers of such plant in this country. None of our workmen or engineers had ever had any experience in working such apparatus, while the foreign factories were already equipped and turning out dimethylaniline by both the competing processes. It would have been useless for us under these circumstances to have started the manufacture here at that time for the production of the only colouring-matter, methyl violet, which we could then have made without paying royalties or infringing patents. We could not have made dimethylaniline here as cheaply as our competitors, even if we had duty-free methyl alcohol in 1880, and it did pay at that time to import it ready-made, and convert it into methyl violet. At that period all the coal-tar colours were commanding such prices that the cost of the methyl alcohol, in those colours which were derived from dimethylaniline, was still insignificant as compared with the margin of profit, and the cost of dimethylaniline did not assume a critical aspect till many years later. The reason why methyl violet replaced Hofmann's violet was not in any way due to the low cost of dimethylaniline. It was because methyl violet is one of those colouring matters which is obtained by a comparatively simple process *directly* from its generating raw material, dimethylaniline. The raw material used in the manufacture of Hofmann's violet is aniline, which is obviously cheaper than dimethylaniline, but the aniline has first to be converted into the dyestuff rosaniline or magenta, and then the latter is converted into Hofmann's violet by the action of the costly methyl iodide. The cost price of Hofmann's violet must for these reasons evidently be very much higher than that of methyl violet. The difference in the cost price of the two colouring-matters was so great that the cost of the methyl alcohol used in converting aniline into dimethylaniline was a relatively negligible quantity.

The same considerations held good in 1880 with respect to methylene blue, malachite green, and other new dyestuffs requiring dimethylaniline or diethylaniline. There were in the first place the patents to be considered. I am not able to state when these expired, but no serious attempt was ever made during my connection with the industry to take up the manufacture of any one of these products. In this case also I am quite confident that the want of duty-free alcohol had nothing to do with the prevention of their manufacture here. Apart from the question of patents there was the fact that in addition to dimethylaniline all these new colouring matters required other raw materials. With the exception of methyl violet every one of the new products necessitated the manufacture of some raw material that had never been made on the large scale before, such as benzoic aldehyde for the malachite green group, phenylnaphthylamine for Victoria blue, toluylnaphthylamine for night blue, etc. None of these new raw materials required alcohol for their production, so that the advantage derived from the use of duty-free methyl alcohol was felt by only one of the raw materials used in the production of the dyestuffs and the proportional advantage conferred upon each colouring matter regarded as a finished product was comparatively trifling. In other words the cost of dimethylaniline as determined by the use of duty-free wood spirit by the foreign manufacturers was not lowered to a sufficiently serious extent to have prevented the manufacture of these dyestuffs here, even if we had been obliged to make our dimethylaniline from duty-paid methyl alcohol. On their first introduction these newly discovered dyestuffs commanded such prices that there was a very large margin of profit. The difference in cost between the dyestuffs made from duty-paid or duty-free alcohol, as compared with this margin of profit, was quite insignificant, and I certainly do not think that the view was ever entertained that these new departures in colour-making had been made impossible for us because of the spirit duties. The causes of the decline of the industry here were frequently discussed in the works and public attention was called to the matter by Dr. Perkin in 1885 and by myself in 1886. There were free comments in the Press both here and abroad, and I had many communications from manufacturers and consumers. The question of the price of spirit was never raised by myself or others. I do not believe it was considered a serious factor down to the year 1880, or even as late as 1886, when our position had already become a subordinate one. Had it been so serious as to warrant the statement now being made that our decadence was attributable to the spirit duties, I cannot imagine that our manufacturers would have waited for nearly a quarter of a century with an industry visibly dwindling away from their works without making some representations.

I do not think it necessary to deal in detail with all the other new colouring matters on the foreign list, as the same considerations are applicable throughout. They were all patented, they required raw materials other than alkylated anilines, and they were commanding prices that left a margin of profit sufficiently great to have made it well worth while to have made them here even if we could not have obtained spirit free of duty. The foreign inventors had naturally taken the lead with respect to their own inventions and had put up the plant and worked out the processes for making all the intermediate raw materials required. As compared with these difficulties, which we should have had to overcome before entering into competition, the question of the cost of methyl or ethyl alcohol was a quite subordinate one. These points are well illustrated by the phthaleins of the eosin group (No. 8), a class of colouring matters introduced between 1874 and 1882, and therefore in the prime of success during my connection with the Atlas Works. The two raw materials required for these dyestuffs are resorcinol and phthalic acid or a substituted phthalic acid. In the manufacture of resorcinol ether is used as a solvent and it may be said that the price of ether was prohibitive. As a matter of fact when the question of taking up the manufacture of these dyestuffs was under consideration by us, the cost of ether was not considered as of very great importance because methyl-

Prof. R. Meldola.

29 Nov. 1904.

ated ether could have been used, and as in this process it plays the part of a solvent it would, of course, be recovered with the unavoidable "working loss." The price of ether was certainly not the cause of our failure to compete with the foreigners in this case. The real reason was that the manufacture of resorcinol on the large scale required very special plant for every stage of the process from the sulphonation of the benzene through the next stage of alkaline fusion and down to the last operation of extracting with ether and recovering the solvent. Then again we did not know at that time how the foreigners were making the phthalic acid, so that on the whole the prospects of successful competition did not look very hopeful, but the ether question was, as I say, regarded as quite subsidiary. The prices paid by the dyers for these new dyestuffs left such a large margin of profit that experiments were made in our laboratory with the object of ascertaining whether it would have paid to make resorcinol here and convert it into the colouring matters by means of phthalic acid purchased from the foreign makers. I did not make these experiments myself and I have no quantitative records, but I remember distinctly that it was shown that, taking the methylated ether at the price paid here, there would have been an ample margin of profit. Nevertheless the manufacture was not taken up here during the period I am dealing with. Soon afterwards another group of phthaleins, viz. the rhodamines, were introduced (also by the foreign manufacturers) and these must have more or less replaced the eosin group of dyestuffs.

The colouring matters on the foreign list comprised under No. 6. may be said to have marked a new epoch in the coal-tar colour industry on account of the enormous importance which they have since acquired and the colossal scale on which they are manufactured. Their discovery and their success abroad and our failure to make them here had nothing whatever to do with the cost of spirit during the early period of their introduction, which was from 1884 onwards. The only raw materials requiring the use of alcohol for these first representatives of the group were benzidine and tolidine. The alcohol in these cases was employed only as a solvent. Had these dyestuffs been discovered and manufactured in this country we could have used methylated spirit and recovered it after the operation as in the case of aniline blue. The cost of the spirit would have been no obstacle to their manufacture.

The general drift of the evidence submitted is to show that during the period dealt with when our colour industry was being seriously affected by the inventive activity of the foreign manufacturers, our failure to keep pace with our competitors cannot be attributed to their having the use of duty-free alcohol. I have dealt with the subject purely in its *historical* aspect, and, to the best of my belief, as accurately as memory unaided by documentary records in any form can make it. I should like to add that my conclusion that the loss of the colour industry during the early period of its growth had nothing to do with the spirit duty is quite independent of the question now under consideration, viz., whether it would be advantageous for manufacturers to have the use of duty-free spirit now. The conditions have changed since I left the industry in 1885. Prices were falling from 1880 downwards and the margin of profit becoming smaller and smaller. The difference in the cost of manufacture due to the use of duty-free spirit would now bear a very much larger ratio to the margin of profit, and whereas this difference was formerly for all practical purposes a negligible quantity, it may now have become a serious factor. For this reason I wish to place upon record my opinion that it is now desirable that our chemical manufacturers should be placed upon the same footing as their foreign competitors so far as concerns the use of duty-free alcohol.

. Dr. CHARLES DREYFUS, called; and Examined.

Dr. C. Dreyfus.

29 Nov. 1904.

1467. (*Chairman.*) I understand you are the managing director of the Clayton Aniline Company?—I am.

1468. And that you have been connected with the dyeing, calico-printing, and chemical industries for the last thirty-five years?—Yes.

1469. Has the Clayton Aniline Company itself been of long standing?—The company with which I am now connected has been in existence about twenty-seven years.

. 1470. They are engaged in the manufacture of what?—In the manufacture of raw materials from coal tar, and also in the manufacture of coal tar colours.

1471. I believe you are also a member of the executive of the chemical section of the Manchester Chamber of Commerce?—Yes.

1472. And you hold a degree in the University of Strasburg?—Yes.

1473. In Natural Science or in Chemistry?—In Natural Sciences.

Clayton Aniline Company: High duty on alcohol a deterrent to its use.

1474. Have you given much attention to this question of the use of alcohol?—Yes, I have had to do that in connection with my business.

1475. To what extent is alcohol used by the Clayton Aniline Company?—At present it is not used at all, except in the laboratories for research work.

1476. To what extent do you use it in the laboratories?—It is used there to a very small extent.

1477. In the past the company have used spirit, have they not?—They have used it in the shape of methylated spirits, but only in very small quantities indeed.

1478. Is that because alcohol is not required for the purposes of their industry, or have they been deterred from using it by any other reason?—We have been deterred from using it owing to the high price of pure alcohol.

1479. When you speak of the high price, do you mean the high price if duty were paid?—With the duty included.

1480. For what purposes would the company have wished to use it?—We would have wished to use it for the purposes of methylating aniline in order to make mono-methyl aniline and di-methyl aniline, which is a raw material extensively used in the manufacture of aniline dyes. I find that of the 673 colours mentioned in the well-known tables of Schultz and Julius about 27 per cent. are produced with the help of alcohol. Those tables contain practically all the dyes and colours which are used.

Proportion of modern dyes made with alcohol.

1481. That 27 per cent. would represent about 150 colours, would it not?—About 180.

1482. (*Dr. Thorpe.*) When you say alcohol in this connection, what do you mean?—Pure methyl alcohol and pure ethyl alcohol—I mean both. Almost all basic colours are made in this way. This class of colours is most important for the very flourishing English lake industry, which is carried on for the manufacture of wall-paper colours and paints which is almost entirely supplied by German and Swiss firms. This industry takes up enormous quantities of aniline colours, in some cases far more than a dye or print works of similar size would consume.

1483. (*Chairman.*) Which industry is that?—That of the manufacture of lakes for wall-papers, lithographic colours, and paints for ordinary painting purposes. This is quite a new industry which has actually only come to the front within the last two or three years, but which consumes a very large quantity of dyes. As these colours, which are sold in very large quantities, belong to the 27 per cent. of alcoholic colours, in my opinion the actual percentage of colours requiring alcohol on the bulk of the colours which are sold, must approach or exceed even 50 per cent. of all the aniline dyes imported into the United Kingdom. I have a list of some of those colours which are important and which is not very long, so if you will allow me I will just give it:—Greens; brilliant green, and malachite green; yellows; auramine and tartrazine; reds; safranine and the rhodamines; blues; gallocyanine; basic blues, and methylene blue; violets; methyl violets. Then for those that are specially intended for cotton-dyeing I have put down chrysophenine, which is

used in enormous quantities for this purpose, being a pretty fast yellow; and a great number of the so-called diamine colours in the following shades—yellow, red, scarlet, and blue; also diamine and diphenyl blacks and many others.

Methylated spirit only suitable when alcohol is required as a solvent.

1484. Taking those colours that you have mentioned, you would not surely go so far as to say that absolutely pure ethyl or methyl spirit is necessary for their manufacture in all cases, would you?—Almost in all cases. Take, for example, the oldest of them all, methyl violet. To make methyl violet you must make dimethyl aniline, and for that you cannot use any other than pure methyl alcohol. If you were to denature it by methylating it, it would not give a proper chemical result in the treatment. In all other cases, or almost all, with a very few exceptions—and these exceptions are only when the spirits are used as solvents—methylated spirit could be used; but in the chemical reactions which are taking place where the radicals of the alcohol, whether methyl or ethyl, enter into the composition of the colour, it would not be possible to use any but the pure spirit.

1485. Is that not contrary to actual experience in this country in former days, when we did manufacture some of these colours; did not our manufacturers then as a matter of fact use methylated spirit?—I have no experience of that.

1486. We have just had it in evidence that taking, for instance, aniline blues which were manufactured from 1870 to 1885 in this country to a large extent, and also in the case of the Hofmann violets, pure spirit was not necessary?—I happen to know about the aniline blues, because it is now about twenty-nine years ago that I was manufacturing them in connection with another firm that I was with before I joined the Clayton Company. In that case it was used as a solvent only, and did not at all enter into the colour product. The manufacture of the aniline blues as carried on at that time, Professor Meldola, having made them, would have been able to explain to you quite as well or better even than I can. The rosaniline base was heated with aniline and a crude blue was obtained and that crude blue was purified in stages with methylated spirit, and became after the various stages of purification, the purest blue—the so-called light blue—the others being redder and not so pure.

Pharmaceutical products and synthetic perfumes. Application for use of pure spirit by Clayton Aniline Company (1904). (See Q. 1494, footnote; also 1502-5 and 1539-41.)

1487. Going away for a moment, from the coal tar dyes, would you mention any other industries in which the use of pure spirit is a necessity?—I think in the manufacture of the finer pharmaceutical products it would be very important if we had pure spirit free from duty. I am referring especially to those synthetic pharmaceutical products which are used so largely and which were introduced perhaps seventeen or eighteen years ago. One class of these products is what is called antipyrine. Then there are the artificial perfumes as well, such as artificial musk and artificial vanillin, and artificial violet, which, I believe, is called ionone.

1488. Have you any personal experience of the manufacture of artificial perfumes, or of these pharmaceutical products, such as antpyrine?—I have no personal experience about these manufactures, but we were on the point of starting the manufacture of some of these ourselves from processes that were brought from abroad. When we were confronted with the question of the alcohol we had to abandon the manufacture for the present.

1489. At what period was that?—It was only about six months ago that we acquired some of these processes.

1490. Do you say that when you came to examine what the cost of the manufacture would be, you found that the price of the spirit would be fatal to you?—It is not exactly that; it is the difficulty in getting the alcohol at all that confronted us.

1491. Did you ascertain what the conditions were under which you could obtain it?—We ascertained that, and we found that we could not obtain it at all.

1492. (*Dr. Thorpe.*) Not six months ago?—Not six months ago.

1493. Did you make the application to this Board?—We made application to the highest Excise official in Manchester.

1494. (*Chairman.*) Can you remember exactly what you said?—I can send you the correspondence* we had at the time, the queries that we made, and the answers that we received.

Alcohol question prior to 1902. Process for making oxygen. (See post Qs. 1513-38.)

1495. (*Dr. Thorpe.*) Did I understand that it was the preparation of synthetic perfumes that you were contemplating?—Yes. I recollect also a case which I have not put in my *precis* because I had forgotten it. Myself and some other gentlemen had acquired a process for making oxygen out of atmospheric air by a process patented by Professor Pictet of Berlin and Geneva. In the course of the experiments that we had to make to try the efficacy of the process, we had to use ethyl alcohol as pure as possible, and we unfortunately could not get it; we got it in the shape of methylated ethyl alcohol.

1496. (*Chairman.*) At what date was that?—That must be about three years ago.

1497. (*Dr. Thorpe.*) You mean that you could not get it duty free?—We could only get it in the shape of a methylated alcohol.

1498. And you could not get it duty-free?—At that time we did not want to get it duty free. We wanted to get it as pure as possible, but, unfortunately, they had to methylate it in such a way that it occasioned the greatest difficulties to make oxygen from it.

1499. Pardon me, you could get it duty paid as pure as you wanted it?—That would have been too expensive.

1500. That is another matter; apparently it was not worth your while to go to a little expense for the experiments?—We wanted a very large quantity.

1501. Even for the preliminary experiments?—Yes. The experiments were carried on on a pretty large scale, as we were making 50 cubic metres per hour of oxygen.

1502. (*Chairman.*) Do you remember what the objections taken by the officer in Manchester were?—I could not tell you exactly; I have forgotten now his reasons. *See Qs. 1493-4 and footnote.*

1503. You are aware of the terms of the Act of 1902, of course?—Yes, I have seen those, but even there I find there are some difficulties.

1504. I suppose you made your application under the Act of 1902?—We did.

1505. (*Dr. Thorpe.*) Did you specifically refer to the Act when you made your application?—No, we did not. We understood that the officials in Manchester ought to know about the Act better than we would.

1506. (*Chairman.*) Whom did you address—was it the collector?—I think it was the highest official, who would be the collector of inland revenue in Manchester.

Finance Act, 1902. Its beneficial application hindered by high price of spirit, especially in the case of aniline dyes.

1507. Now going back to the Act of 1902, you say you see in that Act obstacles to doing what you wished even were we willing to apply the Act?—There would be the difficulty that whereas in Germany they get their spirit at about 10d. per gallon I believe as a maximum, I understand that there would be an additional 5d. as a kind of duty put on that spirit if it were imported from Germany.

1508. That is hardly the point is it—the question is what could you get the spirit for in this country. It is conceivable that your imported spirit might be dearer than if made in this country?—There would be no doubt about it probably, that if it were manufactured on a large scale in this country, the spirit could be produced quite as cheaply in this country as it is abroad. At any rate, there is no reason why it should not be, because the raw materials here are not more costly than they are abroad—fuel, for instance, is quite cheap.

1509. Without going into any reasons, so far as you are concerned, I understand that you could not venture to undertake these operations, unless you could be assured of getting your spirit at a price not exceeding the price that your German competitor would have to pay for his spirit?—That is so.

Cost of spirit less important in making fine chemicals and synthetic perfumes.

1510. Even a small difference would preclude you from undertaking the work?—A small difference would make the manufacture of these articles less remunerative, or, perhaps I should say, would not let us have a chance of competition. In the very fine chemicals there

* The witness subsequently wrote that this application did not specifically mention synthetic perfumes. It was in fact the application, referred to in Questions 1588 to 1590 *post*, for the use of pure spirit for laboratory research work.

Dr. C. Dreyfus.
29 Nov. 1904.

is a very large margin of profit, and a small difference applied to those articles would not prevent our manufacturing them; but a small difference in the case of the aniline dyes would, I think, preclude us from competing.

1511. On these artificial perfumes you could perhaps pay a small difference?—Yes, a small difference there would not prevent us from manufacturing them.

1512. (*Mr. Tyrer.*) That is, so long as they keep up the high price?—I think it is likely to be kept up as it is, because the manufacture is very difficult and requires the greatest chemical skill and the best mechanical appliances. It is not one that everyone can enter into.

Oxygen. (*See* also Qs. 1495–1501.) Special quality of methylated spirit used.

1513. (*Dr. Thorpe.*) Before you pass from that, may I point out that we are rather mixing up matters. You have now gone off to the general question, and passed away from the specific question as to your application; but I should like, with the Chairman's permission, that that specific question should be followed out. As I understand, you asked for a certain quantity of alcohol to be allowed for experiments which you were making in connection with a patent for the manufacture of oxygen, which you had purchased?—Yes.

1514. And you said, as I understood, that you were precluded from entering upon those experiments by the high price of the alcohol?—I am afraid I have not explained myself sufficiently clearly. What I wished to say was this—that we had to buy methylated alcohol. We got permission to use a smaller degree of methylation than is in ordinary methylated spirit; but even that methylated alcohol, which was purer than the usual methylated spirit, was not pure enough to give us good results.

1515. How did you get that permission to use a special kind of methylated spirit?—From the Excise officer in the district where we carried on the experiments, namely, in the Hyde Road district of Manchester.

1516. What was the special character of the methylated spirit you were allowed to use, may I ask? Was the proportion of methyl alcohol less than it ought to be, or what was the special nature of it?—I believe there was less of the methyl alcohol in it.

1517. That there was less wood naphtha added?—I believe so.

1518. You were allowed to do that by the Excise officer of your district?—Yes.

1519. (*Chairman.*) At what date would that be?—That would have been about two and a half years ago.

1520. (*Dr. Thorpe.*) Did you yourself make the addition of the wood naphtha?—No, we bought it ready made.

1521. From a methylator?—Yes.

1522. In Manchester?—I believe it was either Manchester or Liverpool—I think the Manchester methylator, if I recollect rightly, put too much of the methylating article in it, and we had to go afterwards to a firm in Liverpool, who gave us a much better article containing more pure ethyl alcohol, and that it was with that that we made our experiments.

1523. (*Chairman.*) Still that was a methylated spirit?—It was a methylated spirit.

1524. Have you any reason to say that it had less than 10 per cent. of wood naphtha in it?—How much it had in it I do not know, but I know it contained less than the usual amount of methylated spirits.

1525. I do not think it can have done so, but there is methylated spirit and methylated spirit. I mean different qualities of the article are made by different manufacturers possibly. I do not think that you can possibly have had less than 10 per cent. of wood naphtha, because that would be against the law?—It might be that it had less of the other impurities.

1526. (*Dr. Thorpe.*) That is really what I want to get clearly from you; and that is the point of a great deal of this. It might be possible in your case to produce a kind of wood naphtha which might contain less of the acetal, the pyridine, and the empyreumatic matters generally than what we usually sanction; but there would have to be 10 per cent. of that relatively pure wood naphtha added to your methylated spirit?—That might be. I know we had it from a firm in Manchester first, and that that would not do at all.

1527. You said that for your experiments the presence of methyl alcohol was objectionable?—Either the methyl alcohol or the impurities that were in the methylated spirit.

1528. You have said that you got a specially pure kind of wood naphtha for the purpose?—I think so; it was better, at all events, than the one we had at first.

1529. Therefore the betterment could not have been in decreasing the amount of methyl alcohol, but must have been in decreasing the amount of the associated matters with the methyl alcohol?—Yes—the other matters.

1530. Will you say even then you could not go on with your experiments?—We finished them, but we had a great deal of difficulty, because we had to use a much larger amount of the products than we would have had to use with the pure ethyl alcohol. We could manage to finish the experiments.

1531. You did the experiments then?—Yes.

1532. Were you able to form your own conclusions as to the character of the purchase you had made?—Yes.

1533. Then that enabled you to get at the facts that you wanted?—Certainly.

1534. In that respect the experiment was satisfactory?—Certainly.

1535. Therefore, having satisfied yourself with the experiment, it was not necessary for you to ask for a special concession from the Board of absolutely pure alcohol?—Quite so.

1536. (*Chairman.*) Do I understand that your experiments resulted in your rejecting the idea of adopting this process as a process of manufacture?—We have not abandoned that process for the manufacture of oxygen; that is still going on.

1537. (*Dr. Thorpe.*) As the result of these experiments?—Yes. We found fortunately that we could do without alcohol at all.

1538. (*Mr. Tyrer.*) So far as the oxygen was concerned?—Yes.

1539. (*Chairman.*) Now let us come to your later efforts six months ago, as regards artificial perfumes; there you made your demand for absolutely pure spirit, I suppose?—Yes, for pure alcohol. (*See ante* Q. 1494 and footnote).

1540. And that was rejected?—Yes.

1541. If that had been granted would you have used very large quantities?—It would depend entirely on the state of the trade. You know it is difficult with a new industry to give an idea of what quantities might be used. We would have to feel our way—to begin with small beginnings, and perhaps extend gradually as we got on.

1542. Is the quantity of alcohol required to produce a given quantity of a finished article, such as antipyrine, large?—It is pretty large.

1543. You refer in your *précis* to the production of fatty substances for butter; have you had any experience yourself of those?—I have no personal experience in that direction. It is only what I have heard from friends who are in that industry.

1544. Then I think, perhaps, we will not pursue that further. Might the same be said about the artificial silk industry?—That, of course, I have also no personal experience of. My personal experience is only in connection with aniline dyes and the finer chemicals, such as perfumes and the raw materials for perfumes.

Alcohol for light, heat, and power. Methylated suitable but too costly.

1545. You refer further down in your *précis* to the large quantities of spirit that might be used for domestic purposes, such as lighting and heating, and for driving power with stationary and motor engines. The spirit at the present time can be used duty free for all those purposes, can it not, in the form of methylated spirit?—I do not know whether it is used for all those purposes in this country. I know it is used very largely in every household in Germany.

1546. It is used very largely for household purposes in this country, is it not?—Yes.

1547. And what is so used is duty free?—Except, perhaps, with that countervailing duty on it.

1548. That may or may not be the case. If made in this country it may be absolutely duty free, only it must be methylated?—Yes; and for those purposes methylation does no harm at all.

1549. Therefore, really for these purposes there is no obstacle placed by the present law in the way of the use of alcohol to almost any extent?—Except, perhaps, that the methylation makes it a little more costly.

1550. And that might or might not be a matter of very great importance according to the circumstances?—I am not in a position to give evidence on that point.

Question of denaturants in lieu of wood spirit.

1551. As regards the methods of denaturing spirit other than the one which is prescribed by law and which results in what we call methylated spirit, have you any suggestion to make as to other methods that might be adopted?—I would suggest the same methods which have been proved practicable abroad for the purposes of the colour industries, of which I believe the best evidence is to be found in Mr. Tyrer's paper (*see* The Journal of the Society of Chemical Industry, No. 5, vol. xxiii.)

1552. Those denaturing processes are all intended to be applied in the factory where the spirit is going to be used; and the German Government would not allow spirits denatured in any of those ways to be sold freely in the country. They are all methods of denaturing which have a temporary value for that purpose and are special to the particular industries, the denaturing agent being capable of being easily removed if people were given a little time and the opportunity, in many of the cases. Is that not so?—I do not know exactly how that would be. If you had to put ethyl chloride or methyl chloride into alcohol, I think there would be some difficulty in the way of getting it out entirely. Of course if you had to put sulphuric acid, that could be got out by simply neutralising it and distilling it over again; that would not in my opinion constitute a sufficiently safe denaturing agent.

1553. These really constitute special methods of denaturing for a particular purpose; but you must secure that the spirit so denatured is used for that particular purpose, and you cannot allow it to be sold in a shop, for instance, on the chance of its being used solely for that purpose, can you?—Could not the same arrangements be made with large manufacturers of dyes in England, for example, as are made by the Excise authorities in Germany.

Conditions of special denaturing under Finance Act, 1902, explained.

1554. Certainly, they can now under the Act of 1902. For instance, if you wanted to use spirit, and came to us to ask leave to do so we should first ask you why the ordinary methylated spirit did not suit you. You would then satisfy us on that point, and we should then say to you, this spirit will be brought absolutely pure into your factory, but before you begin to use it in your factory we should like you to put something into it which will denature it sufficiently to prevent its being used for other purposes than the particular manufacture you want it for; and you would have to suggest in each case what you think is a suitable method of denaturing?—I think we could do so in every case. But I wanted to point out to you that as far as pure ethyl alcohol is concerned, I do not think we could at present buy it in England. Later on, no doubt, there will be manufactories set up for manufacturing the pure alcohol if there is a demand for it; I have no doubt that will come about as a consequence of the use of alcohol in industrial undertakings. But at present if we had to import it from abroad, would you allow it to be denatured abroad or at the port of arrival?

1555. It must be denatured after it arrives in this country?—At the port appointed by the Excise authorities?

1556. Yes.—We would accept even that as a practical method.

Absolute alcohol. Possibility of obtaining it in England. (*See also* Qs. 1611–23 and 1643–56.)

1557. You cannot get in this country spirit of the necessary purity and the necessary strength for the purposes you require, I understand?—I have not succeeded in getting the ethyl alcohol pure enough, but the methyl alcohol I could get some time ago.

1558. Do you want the ethyl alcohol up to 95 per cent.?—We want it as pure as possible, free from acetones or any other impurities. We want it, if possible, chemically pure; the purer it is and the better it will answer the purpose.

1559. (*Dr. Thorpe.*) You are speaking now of ethyl alcohol, are you?—Of ethyl alcohol and also of methyl alcohol.

1560. Let us keep the things separate. A fermentation product is already free from acetones, is it not?—Yes.

1561. So with it you would only get water?—We should get the water and it will sometimes have other impurities in it.

1562. Minute traces of amyl alcohol?—Yes.

1563. Substantially when you buy spirit you get alcohol and water, do you not?—Alcohol, water, and sometimes colouring matters. I do not know how the colouring matters get in, but they are there sometimes.

Precautions against misuse of pure spirit and recovered spirit.

1564. (*Chairman.*) I suppose in many processes of manufacture it would be possible to devise apparatus which would secure the spirit during the process of manufacture?—I would be quite willing to work with closed vessels and with locked reservoirs which are only accessible to the officers of the excise.

1565. But all that would, of course, have to depend upon the particular manufacture that you were dealing with; in some it would be possible, and in others it would not?—Yes. We would also require permission to be able to distil the spirit so that the recovered spirit could be used over and over again. That I suggest could be done in stills that are absolutely closed, and the product of the distillation could be run into closed tanks also, so that by no chance could any of the workmen get at the pure spirit which at that stage would be a potable spirit.

Petroleum as a denaturant for extractive purposes.

1566. You mention in your *précis* that spirits for extracting purposes could be mixed with petroleum which would be harmless in many cases?—That would be so, for extracting purposes.

Concession by Board of Inland Revenue to Clayton Aniline Co. in 1897 (*see* Qs. 390–413); concession not made use of, though it admittedly removed any Revenue restriction to manufacture of dimethyl aniline.

1567. Were you connected with the Clayton Aniline Company in the year 1894?—Yes.

1568. Do you remember an application that they made to the Board of Inland Revenue at that time to be allowed the use of duty-free methyl alcohol, and that the Board agreed that the company might do so on mixing it with a certain proportion of mineral naphtha?—I have a recollection of it. At that time we had Professor Green as head of the aniline dye department, and he had the matter entirely in his own hands. I did not interfere at that time with his department at all.

1569. Was that particular correspondence with the Board of Inland Revenue carried on by Professor Green?—Yes.

1570. And did it not come before you?—It might have come before me, but I did not take much notice of it at the time.

1571. (*Dr. Thorpe.*) As you say, application was made on behalf of the company by Mr. Green, who was the servant of the company, and I was requested by the Board of Inland Revenue to go down to the Clayton Aniline Company and see what could be done with a view of meeting the requirements of the company. It was arranged between Mr. Green and myself that if the pure methyl alcohol was mixed with one-twentieth of 1 per cent. of mineral naphtha—a substance suggested by Mr. Green himself—that would suit, as your own correspondent says, "our purpose quite well." That was sanctioned by the Board, and you were allowed to use methyl alcohol with this addition of one-twentieth of 1 per cent. of mineral naphtha. That, I venture to think, must have come before you, as one of the Directors of the Company?—It came before me, certainly, and I gave permission to Mr. Green to go ahead.

1572. He told us that the company never gave him permission, and he regretted very much that they had not done so. It was his own advice that they should, he pressed it before you, but you did not give him the permission?—Yes, he got the permission to go ahead; and I recollect giving him the articles which were wanted at the time. It was for dianisidine.

1573. There is a conflict of evidence here, so I will turn up the actual evidence of Mr. Green on that point. In Question 391 I asked: him "In 1894, I find from the minute furnished to me that the Clayton Aniline Company, Limited, were allowed to import methyl alcohol for experiments in making aniline dyes

Dr. C. Dreyfus.

29 Nov. 1904.

and dimethyl aniline under Treasury sanction on payment of the surtax only; you have no personal knowledge of thatf act? (*A.*) No." He was not then, in 1894, in your employment. My next question was: "In 1897, when you were a chemist to the company, the Clayton Aniline Company were allowed by the Board to use duty-free methyl alcohol for the manufacture of these substances, on condition that such alcohol was mixed with one-twentieth of 1 per cent. of mineral naphtha—a condition which the company stated would suit their purposes quite well. Were you aware of thet fact? (*A.*) Yes. (*Q.*) I think we personally arranged that condition? (*A.*) Yes, we did. I made the experiments myself with the material, and I found it quite satisfactory for the purpose. (*Q.*) You have told the Committee that your company did not avail themselves of this concession? (*A.*) No, they did not. (*Q.*) You made no further application for permission to use methyl alcohol? (*A.*) No. (*Q.*) Would you kindly tell the Committee why you found it inexpedient to take advantage of this concession? (*A.*) It is difficult to say why the Board would not do so. I pressed the matter on them. I considered that with that concession and with the price of dimethyl aniline then ruling, there was a substantial profit to be made upon the manufacture of dimethyl aniline. From that point of view I pressed the managing director to start the manufacture, but after considering it they decided not to do so—I believe they felt there was not sufficient profit"?—My impression is quite a different one from that of Professor Green. I think at the time he wanted it for making another article.

1574. Did you make the other article?—No.

1575. Would you mind telling us why you did not make dimethyl aniline or the other article?—As far as the dimethyl aniline is concerned, we found first of all that the consumption in England was very small indeed, and that that which was consumed in Germany we would have no chance of competing with.

1576. May I point out to you that it was on the ground of being able to make this very thing that you made application to the Board?—That is so.

1577. Therefore, it cannot be said that the Board of Inland Revenue has placed any obstacle in the way of the manufacture of that particular thing, dimethyl aniline, or indeed any other methylated derivative for which that substance containing one-twentieth of 1 per cent. of mineral naphtha would do?—Certainly not. I think the Board have met us very handsomely.

1578. In fact we strained the law, because this was long before 1902; everything that was in our power, and more than was in our power, was done for you?—Certainly.

Removal of hindrances to use of alcohol. No concerted action prior to 1902. (*See* also Q. 1632-4.)

1579. (*Chairman.*) That brings me to the paragraph in your *precis* in which you say that "Manufacturing chemists and chemical societies, as well as Chambers of Commerce, have agitated for some years to obtain the removal of the hindrances to the unrestricted use of alcohol for industrial purposes, but without success." In that particular case of which we have been speaking the application was not objected to. Can you tell us of any other applications that were made and were refused by the authorities?—I do not recollect any applications that have been made since 1897, except—but that is not important—some applications for using pure alcohol for scientific research in our laboratories.

1580. That was in this year, 1904?—Yes. I do not think that has been granted. We did not pursue it any further. The quantities we use for the purpose only come to about ten to twenty gallons a year, so we thought it was not worth while going to all the trouble.

1581. The exact point of that statement in your *precis* is that there has been this agitation for years, but that it has been unsuccessful owing to the refusal of the authorities; could you support that statement by positive evidence, or is it only founded on a general impression?—Not since 1897, when we made our last application, I think; and as I have admitted, as far as we personally are concerned, we have been certainly met most handsomely in the way of the use of pure methyl alcohol by the authorities here.

1582. Then so far as your own personal experience goes you really have had no reason to complain?—Certainly not, except that I do not know how it would affect works starting in a small way if they had to comply with all these regulations which are laid down in the Finance Act, 1902. To a large works which may consume a large quantity of alcohol, the regulations as to the payment of the Excise officers would not be of any great consequence, but to a very small works which is only feeling its way it might have some drawbacks.

Finance Act, 1902, S. 8; payment for supervision a possible hardship for small businesses.

1583. It is for each applicant for a concession under the Act to determine for himself whether the conditions which the Board of Inland Revenue might impose would or would not stand in his way. You cannot raise any general objection to the Act surely on that ground? It is simply a question of the circumstances in each case, and until the Board of Inland Revenue have stated the conditions that they will require the applicant to follow, it is impossible to say whether or not the Act is suitable or not, is it not?—I do not know how it would affect a small manufacturer starting in a small way just to see how these alcohol preparations would do.

1584. I suppose you will admit that we must have conditions, will you not?—Yes.

1585. The idea of alcohol being used duty free and in a pure state, with no sort of conditions, is quite out of the question?—There certainly ought to be regulations.

1586. All that the Act says is that the regulations are to be suitable to each occasion. You cannot get anything better than that in an Act of Parliament, can you?—No.

1587. So that, so far as the law is concerned, there really is not room for any great improvement?—How is it then, that the Act, which in itself seems to be fair enough, is causing so many difficulties with officials?

Clayton Aniline Company's application for pure spirit in laboratory work. Reasons for refusal by Board of Inland Revenue.

1588. Is it; that is the question?—I have only had one experience. I wanted to buy a small quantity of pure alcohol for research work in our laboratories, where we employ about half-a-dozen research chemists, and pure alcohol, more especially the pure ethyl alcohol, is almost a necessity; I wanted to import some from Germany, and the Germans have their agents in London, from whom I wanted to buy, but they said: You must get authority from the Excise officials; and I never got that authority.

1589. That is hardly a matter, after all, which that section of the Act of 1902 is intended to apply to; that section was intended to deal with matters of large importance, and it was not intended, I think, to save an individual £4 or £5 in the course of a year?—No.

1590. That was the reason, I take it, which operated in your particular case, and of course we dealt with you just as we did with other people. Where an individual comes and says: I want to use about ten gallons in the course of the year, and I should like to use it duty-free, we say no, because, after all, if you multiply largely the number of individuals you will probably reach the maximum amount of risk for the community for the sake of an insignificant benefit to a certain number of individuals. Do you, from your experience, know of other people who regard the Act as imposing hindrances?—It seems to be understood by some of our chemical friends in Manchester that there are hindrances.

Provisions of the Act admitted to be satisfactory if liberally administered.

1591. The point is, can you define those hindrances? That sort of general assertion is not really of very much help to the Committee, is it?—I cannot point out any hindrances if the Act is properly administered.

1592. Therefore, so far as legislation goes, there is no great ground of complaint, and it is purely a question of how the Act is administered?—That is so.

1593. Now we come to how the Act is administered; can you specify objections to the manner in which it has been administered?—I have had no experience of it, because I have never had any occasion of availing myself of this new Act of 1902.

1594. With the exception of the particular case that you referred to just now?—That is a small matter.

1595. (*Dr. Thorpe.*) Do you mean now your laboratory experiments or your other experiments?—The laboratory experiments.

1596-9. (*Chairman.*) What was the other matter that you referred to?—That was the matter of alcohol for the production of oxygen. That was before the Act of 1902 was passed.

See ante Q. 1495-1501 and 1513-38.

1600. You cannot help the Committee as regards that particular point in the inquiry, which is the administration of the Act of 1902, by giving any very distinct and definite evidence as to the manner in which it has been administered ?—I could not, because I have no experience of the Act.

1601. (*Mr. Tyrer.*) You have admitted that some amount of supervision is necessary ?—Certainly.

Cost of Excise supervision under Finance Act, 1902, may be an objection to small manufacturers,

1602. And your opinion is that, so far as you have heard, and so far as your reading of the Act of 1902 goes, with its accompanying regulations, unless the manufactory is large—or one may use the term that is used in those regulations, unless it is of sufficient magnitude—even otherwise reasonable regulations might be irksome to the small manufacturer ?—Yes, that is what I say.

1603. Do you happen to know what amount of regulation or supervision there is abroad ? Take works of the size you put up within the last few years; what amount of supervision would there be on such a works in Germany ?—I could not tell you. I do not know what supervision there is in the foreign works.

1604. Do I understand you to say that you have had no experience of that supervision at all ?—None whatever of the supervision in foreign works. I have never been in the employ of a foreign works.

1605. Is it your impression from visiting the Continent and talking with manufacturers there that the supervision is light or heavy ? That is rather a loose term, I know, but still, take the case here; the supervision here is practically quite intimate during the working hours—the officer must reside on the premises—more than one officer probably— and so on. Are such conditions imposed in Germany, do you know ?—I do not know what conditions are imposed in Germany. When talking to the chemical manufacturers in the same line of business as myself, whose works are abroad, I have noticed that they generally changed the subject at once, and that they will not give me any information.

1606. That is as to the amount of the supervision ?—That is so.

1607. That is rather interesting, because one has not heard of very great reluctance on their part to give information of that kind. Still, it is clear in your own mind that the industry must be within limits large in order to endure the supervision which, under existing circumstances, would be probably considered necessary ?—It must be of a certain size.

but not prohibitive in the case of synthetic perfumes.

1608. Having regard to the comparatively small production, and the operations generally in connection with the synthetic perfumes, would you say that the size of the works might prevent adequate supervision, but as regards profits they would cover the cost of supervision ?—That is quite possible.

1609. In other words, having regard to the present relation of profits to cost, the question would not hinder you submitting to a fair amount of supervision ?—That depends entirely on the cost of the supervision to the manufacturer.

1610. For the particular industry which you are contemplating could you, do you think, stand a cost of supervision amounting to £400 per annum ?—Yes, it could stand such an expense for supervision.

Absolute alcohol. (*See* Qs. 1557-63, also 1643-56.)

1611. In the course of your evidence you have spoken of the purity of alcohol, and I came to the conclusion, from what you said, I am sorry to say, that we are not able to produce—or, at least, we are not producing for commercial purposes and uses—an ethyl alcohol which is sufficiently pure ?—We have never been able to get one in England yet.

1612. Are we to take it that the ordinary alcohol, as supplied in the ordinary way for commercial purposes in colour industries in Germany, is purer ?—It is 100 per cent. alcohol.

1613. Do you want absolute alcohol ?—Yes. I am afraid Dr. Thorpe misunderstood that part of my answer. When speaking to him of the ethyl alcohol I was referring to the percentage of pure alcohol in it.

1614. (*Mr. Nicholson.*) You also objected to it on the score of its colour as made in this country ?—I said there is sometimes colouring matter in it, but that it is very small.

1615. More in this country than in Germany, would you say ?—I have never seen any crude ethyl alcohol from Germany. What I have seen of it has always been the purified article which has been made free from water and is what they call absolute alcohol.

1616. Do you assert that the English-made spirit is coloured spirit on occasions, and that you cannot be certain of obtaining a water-white spirit ?—I have never had much of the ethyl alcohol in my hands in England—I mean, of that which is sold for industrial purposes; but I know that I have not been able to obtain from the trade absolute alcohol—I mean, containing from 99 to 100 per cent.

1617. Nor one upon which you could rely on account of its colour ?—I did not say that.

1618. I understood you at the moment as saying that it was coloured on occasions, and therefore could not be relied upon; at all events, I was mistaken in understanding you to say so ?—I am afraid I must have expressed myself wrongly; I did not mean to say that.

Importance of absolute alcohol.

1619. (*Mr. Tyrer.*) Can we take it that the ethyl alcohol you refer to is practically absolute alcohol ?—Yes.

1620. Is the quantity of absolute alcohol in use in Germany for one purpose or another, particularly in connection with the synthetic compounds, whether pharmaceutical or perfumes, or other products of that kind—is that quantity considerable ?—It is very considerable.

1621. Are we to take it that absolute alcohol is a necessity in the production of, at any rate, a large class of these synthetic bodies ?—Yes.

1622. Not the hydrated alcohol, but the absolute alcohol ?—Absolute alcohol is necessary in a great many cases.

1623. The quantity of absolute alcohol in your products is very large, and would therefore pay to be produced in this country if the demand existed; that is your opinion, I presume ?—Yes.

The Surtax. Its effect on price of spirit (*See* also Q. 1635-9.)

1624. The term "duty-free" has been used; what do you understand by the term "duty-free" ?—What I mean by "duty-free" is that there should be neither an Excise nor a countervailing duty on it.

1625. No countervailing duty at all ?—Not on the alcohol. We ought to try to put ourselves exactly on the same line, or I might perhaps say on similar lines, to our competitors abroad.

1626. In other words, the home surtax should be taken off ?—Yes.

1627. Would you in some way or other do away with it ?—Yes, if it could possibly be done.

1628. But that, of course, is a difficult question ?—Yes.

Finance Act, 1902. Its result is to remove all serious legal hindrances to use of alcohol.

1629. Then, broadly, we have it from you that there is nothing in the law, taking the most recent exposition of the law on this subject—namely, the Act of 1902—which seriously hinders an attempt to use ethyl alcohol or methyl alcohol ?—So long as the authorities at Somerset House meet the manufacturers in the same nice and businesslike manner as they have done in the past.

1630. In your case you are perfectly satisfied with the way in which they have met you ?—They have certainly met us very well indeed.

1631. It is only from circumstances internal to yourselves, and from your own choice, that you have not proceeded ?—Precisely.

Misunderstanding of its scope admitted. (*See ante*, Qs. 1579-87.)

1632. (*Sir William Crookes.*) You say you have been for many years a member of the Executive of the Chemical Section of the Manchester Chamber of Commerce; of course, in that capacity, you have come in contact with all the leading manufacturing chemists in that district and know their opinions on these subjects ?—Yes.

1633. Towards the end of your *précis* you say that manufacturing chemists and chemical societies, as well as Chambers of Commerce, have agitated for years to get certain hindrances removed, but without success. You were asked upon that point and you could not, from your own personal knowledge, give any instances of it. Are there any of these manufacturers and chemists who, you think, have sufficient grievances on that point to

Dr. C. Dreyfus.

29 Nov. 1904.

enable them to place information before the Committee that would be valuable?—I think you have heard pretty nearly all those that, as far as I know, in Manchester, have expressed that they had grievances. You heard amongst them the former Chairman of the sub-Committee of the Chamber (Mr. Levinstein) and Dr Rée.

1634. Do you think, beyond what they have told us, there is no further hardship connected with the Act of 1902?—I do not think that there is anything more than they can say. I must confess that there seems to be in the minds of many a misunderstanding as to the scope of the Act. If it were properly understood, that dissatisfaction might disappear.

The Surtax. (*See ante* Q. 1624.)

1635. (*Mr. Nicholson.*) You made the remark just now, in answer to Mr. Tyrer, that you thought the surtax on spirit coming into this country ought to be done away with, as I understood?—Yes.

1636. Do you understand the principle on which that surtax has been enforced?—I do not understand it like an expert; but I suppose it is to guard the home manufacturers and to recoup them to a certain extent for the expense they are subjected to by having Excise officers on their premises to supervise them.

1637. Precisely, therefore, the surtax, if it were removed, would be removed at the expense of the distiller in this country?—But it seems to me such a very high one. Here you have an article which is sold at 10d. a gallon and yet you put a surtax on it which is 50 per cent. of its total value.

1638. I was discussing the principle of it rather than the details. As a matter of principle, if the surtax were removed, it would be removed at the expense of the distiller in this country, would it not?—I suppose that is so.

1639. (*Mr. Tyrer.*) Unless it were retained on the imported spirit?—Yes.

1640. (*Mr. Nicholson.*) Would not some sort of rebate answer your purpose; would that not come to the same thing as far as you were concerned?—I believe I answered a similar question to the effect that we ought to be put on the same terms, as far as the purchase of the raw material is concerned, as our competitors are abroad.

1641. Are you aware that abroad the spirit is, to a considerable extent, state-aided?—I was not aware of that.

1642. We have had that stated in evidence before us. Therefore, if you are to be put on the same footing as your competitor abroad, you would wish the spirit to be State-aided in this country; is that what we are to understand?—No, I should be very sorry to see that.

Absolute alcohol a relative term (*See ante* Qs. 1557–63 and 1611–19.)

1643. (*Dr. Thorpe.*) You spoke about the difficulty of getting what you call absolute alcohol in this country; I think you said you had great difficulty?—Yes.

1644. May I ask whether you get absolute alcohol from Germany?—It has 99 per cent. or 100 per cent. of purity.

1645. How does it come to you, may I ask? I do not wish to be considered as quibbling, but I think we are under some misapprehension as to what is "absolute alcohol." How do you get absolute alcohol from Germany; how do you receive it?—We buy it in the usual course.

1646. That is not quite what I mean; in what form does it come to you—in bottles, or in casks, or in drums, or in what?—In drums.

1647. Sealed drums?—I suppose so.

1648. May I take it that when you talk about absolute alcohol you are talking of a material which every chemist knows is a very difficult kind of thing to handle; it is extremely hygroscopic and if you only expose it to the air for even twenty minutes or half-an-hour, it becomes something less than absolute alcohol. I suppose you are aware of that?—I am quite aware of that. It is most difficult to abstract the last traces of water from the alcohol.

1649. And you do not get it, as a matter of fact, in that state. When you get a 99 per cent. alcohol, you get a very good commercial alcohol, do you not?—I am quite satisfied with 99 per cent., but you see it advertised regularly in the Chemical Trades Journal by two firms in London, who are agents for the German makers of that product.

1650. So-called absolute alcohol?—"Chemically pure alcohol" they call it in their advertisement.

1651. Do they call it "absolute alcohol"?—No, they call it "chemically pure alcohol." I would take it that that implies the fact that it must be absolute.

1652. It ought to be so, of course; it ought to be free from water—that is implied. But you know perfectly well that it is not 100 per cent. alcohol and cannot, in the nature of things, be 100 per cent.?—No; it is perhaps 99 or 99½ per cent.

97 per cent. spirit obtainable from English distillers.

1653. Perhaps not even that. Are you aware that English distillers can make alcohol of 97 per cent., and actually put it on the market at the present time?—I have never seen that advertised by any English distiller.

1654. You are not aware, for example, that Boords advertise that they are in a position to supply alcohol of that strength?—I am exceedingly pleased to hear it, because I prefer to give my business to our own people rather than to go abroad.

1655. (*Sir William Crookes.*) What is called absolute alcohol does not mean 99 per cent. always. It is a trade term. I have no doubt that when a manufacturer really requires it absolute, and asks for absolute alcohol and expects it to be that, that he would get it; but the ordinary 99 per cent. "absolute alcohol" has more water in it than 1 per cent., has it not?—No doubt.

1656. (*Dr. Thorpe.*) If it were absolutely anhydrous, perhaps no chemical reaction would set in, because in the case of almost every chemical reaction a minute quantity of water is wanted in order to start it; is that not so?—Yes, or the other product which comes into the reaction must contain water

SIXTH DAY.

Wednesday, 30th November, 1904

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair*)

The HON. J. SCOTT-MONTAGU, M.P.
Mr. LOTHIAN D. NICHOLSON.

Dr. T. E. THORPE, C.B., F.R.S.

Mr. E. C. CUNNINGHAM (*Secretary*).

Mr. RICHARD WILLIAM SMITH GRIFFITH, called; and Examined.

Mr. R. W. S Griffith.

30 Nov. 1904.

1657. (*Chairman.*) You are connected with the manufacture of smokeless powder, I understand?—Yes.

1658. You come here to represent the Schultze Gunpowder Company, Limited?—Yes.

1659. What position do you hold under the company?—I am superintendent of their factories.

Alcohol for explosives. Use of Methylated Spirits in the hardening process for sporting powders. Its disadvantage as regards character.

1660. Would you explain to the Committee in what parts of your manufacture, and in what ways alcohol is used, or might be used?—The only present way in which we use alcohol is for the so-called hardening process. Our fibrous nitro-compounds when they are first formed into grains are too soft to handle in transit, and it is necessary that they should be hardened. This is done by dissolving more or less of the nitro-compound fibre with a solvent of the fibre, and evaporating the solvent, which leaves the grain in a hardened condition. For this we must use alcohol, more or less.

1661. And you do, as a matter of fact, use it?—Yes, we do.

1662. In what form do you use it?—We use it as methylated spirit—either mixed as a mixture of methylated spirit and acetone, or as a mixture of methylated spirit and ether, or as a mixture of methylated spirit and camphor. Either of those mixtures will perform the hardening process.

1663. On none of those substances do you pay any direct tax, I think?—No, there is no special tax on those.

1664. The ether that you use is probably what is called methylated ether?—Yes, it is.

1665. As regards the character of the methylated spirit for your purpose, is it unsatisfactory?—All our methyl alcohols are more or less unsatisfactory. We have to be exceedingly particular as to our methylation. We generally have it methylated by one firm, and they use the purest form of methyl alcohol that the Inland Revenue will allow.

Special quality used. (*See* also Qs. 1689-91, and 1752-64.)

1666. Then you can get it of a quality that is not unsuitable?—I should not like to go so far as to say it is unsuitable, but one has to be very careful in the use of it. Pure alcohol is much more suitable than any diluted form of methyl alcohol.

1667. Still, assuming that you get the purest methylated spirit that the law allows to pass, or that the Excise Department allows to pass, is that sort of spirit unsatisfactory?—No, but we have to prepare for it. It all hinges on what is known as the heat test for nitro-compounds. By the employment of methylated alcohol in any form those compounds are degraded in purity and in their keeping qualities and in what is known as the Government heat test. We have therefore in purifying our powder and preparing it to make allowance for the use of methylated alcohol. For instance, a nitro-compound that stands a thirty minutes heat test when treated with pure alcohol will stand twenty-five minutes only when it is treated with methyl alcohol. Therefore we have to purify in order to allow for the five minutes more, and that means extra washing and purification.

The heat test

1668. Which all adds to the cost of the manufacture?—Yes.

1669. Do you recover much of the spirit used in that way?—We recover under our processes about 80 to 85 per cent. of it.

Quantities used and lost in manufacture.

1670. Then the recovered spirit is probably somewhat purified from the methylation?—Yes, it is to a small extent.

1671. Do you use it again in its purified state?—Yes.

1672. You do not replace the elements that it has lost?—No, because the elements that it has lost are very small indeed, but yet they have a powerful action upon the nitro-compound. The methyl alcohol distils off equally with the pure alcohol.

1673. Should you say that the spirit at the second or third using is more appropriate for your purpose than it is at the first using?—Yes. But we have to make up the balance each time. If we distil off 80 per cent. we have to add 20 per cent. of freshly methylated spirit to keep the bulk going; so that we are subjecting the grain more or less to the action of the methylated spirit as received.

1674. Then as regards the quantity that you use; taking 1,000 lbs. of smokeless powder made, what quantity of spirit would be consumed in the process?—The quantity that would be mixed with the 1,000 lbs. for the hardening process would be about 25 gallons, of which we should recover 80 per cent.

1675. So that it would only be 20 per cent. of the twenty-five gallons—in other words five gallons, that would be absolutely lost?—Yes, five gallons would be lost.

1676. Does what you have just been saying hold good with regard to all classes of your powders?—No; that refers to the so-called bulky sporting powders. As regards the condensed military and rifle powders, a totally different process is used.

Use of acetone for condensed powders. Alcohol-ether desirable but too costly. (*See* also Q. 1739-51.)

1677. Do you mean that there the alcohol is used in a different way?—Yes. As a matter of fact very little alcohol is used at all in those. We confine ourselves there to acetone, because in that process the solvent is practically all lost. It can only be done by the use of acetone, or alcohol and ether; and as the acetone comes out cheaper than the alcohol-ether mixture it is generally used.

1678. Should you have any preference for alcohol and ether over acetone, if the price were the same?—Yes, certainly; it is a much easier mixture to manage, and it makes a better powder.

The drying process. Its danger avoided by use of pure alcohol for displacing water. (*See also* Qs. 1716-20).

1679. In your *précis* you mention a third way in which the alcohol would be useful?—Yes; that is in the drying process.

1680. As I understand, you do not at present use it for that purpose?—No, we do not, though we should be glad to do so. All explosives makers like ourselves who handle nitro-compounds, but especially fibrous nitro-compounds, look upon the drying operation of the nitro-compound fibre before it has been treated with this alcohol-ether or acetone solvent as the most dangerous operation, and it is undoubtedly the most dangerous, in the whole series of our operations. In Germany, and very largely in America, I believe, processes are used in which the

Mr. R. W. S. Griffith.

30 Nov. 1904.

water is driven out by percolation with alcohol, the alcohol replacing the water in the wet nitro-compound, and doing away with the necessity of drying at all; then the alcohol contained in the grain forms part of the alcoholic mixture that is used for the solvent action afterwards.

1681. In using it for that purpose, is it necessary that the alcohol should be purer than when you use it as a solvent?—Yes, because it brings in a longer action upon the grain, *i.e.* the nitro-compound. For that I should not like to use methylated spirits at all. It is only a process that I should care to adopt if one had pure alcohol.

1682. Then as regards that process, the methylated spirit is unsatisfactory in character, but as regards using it as a solvent the methylated spirit, as I understand you, is on the whole satisfactory, if it is sufficiently good?—Yes; we can do with it as regards its chemical action upon the grain, *i.e.* the nitro-compound by taking care that we have the methylating portion as pure as possible.

Disadvantage of Methylated Spirit as regards cost.

1683. Then as regards the disadvantage of methylated spirit in the matter of cost, methylated spirit, of course, costs rather more than the pure spirit would, if you could get it?—Yes; it costs 5d. to 6d. per gallon more at the present prices that the manufacturers are quoting.

1684. Have you verified that figure?—Yes, recently. I have quotations in my pocket that I have had within the last two or three weeks from manufacturers. Pure spirit is quoted at 1s. 5d., and we have to pay 1s. 11d. for our pure methylated spirit. There is a difference of 6d. in that case, but sometimes it is only 5d.

1685. I suppose the pure spirit which is quoted at 1s. 5d. is spirit at about 65 over proof?—It is spirit at 66 over proof. We must have it at 66.

1686. Have you obtained quotations for methylated spirit by competition?—Yes, we always buy by competition.

1687. I suppose you buy large quantities?—Yes, we do contract for large quantities.

1688. Have you sometimes had it at less than 1s. 11d.?—Never this pure stuff; in fact, twelve months ago we were paying 2s. 1d. for it.

1689. You pay probably rather more than most people would?—Yes, because we insist upon having it peculiarly pure.

See ante Q. 1665–6, and *post* 1752–64.

1690. (*Dr. Thorpe.*) Where does the increase of price come in—in the alcohol or in the wood naphtha?—In the methyl alcohol I take it.

1691. It is the same spirit, but your increased price is in consequence of the superior character of the wood naphtha that you require to use?—Yes.

1692. (*Chairman.*) Now, applying that figure of 6d. per gallon to the figures that you have already given us, it amounts to this, that the cost of manufacture of 1,000 pounds of powder is increased by half-a-crown?—By rather more than that, because of the prior additional purification which would perhaps add another 1s. 6d., making 4s. altogether.

1693. Of course every item of expenditure counts, but tha does not appear in itself a very heavy enhancement of the cost?—No, but in these days the smallest leakage of cost has to be looked into.

Competition in neutral markets.

1694. Is the competition of foreign made powders very keen?—Not so much in this country, as foreign powders do not find favour in this country; but it is very keen abroad.

1695. In neutral markets, do you mean?—Yes.

1696. Does your company do a large export business?—Yes, a good deal.

1697. I suppose to India and the Colonies, but not so much to foreign countries?—Not to France, as there is a monoply there; but to Germany, Italy, and practically every country.

1698. Can you compete in Germany against the German made powders?—No; we are obliged to reduce our price to Germany

1699. Still can you sell at a profit in Germany?—Yes, but it is a very small one.

1700. You do not go quite so far as what they call "dumping"?—No, we do not do that.

1701. I do not think your company has made any application to the Board under the Act of 1902, has it?—Only through the local supervisor at Salisbury. I had full information from him, and he gave me to understand that the requirements of the Board of Inland Revenue would be considerable in the way of attendance and supervision; so much so that I thought the cost of the one would eat up the saving on the other.

Finance Act, 1902. Cost of Excise supervision probably greater than saving in cost of spirit, except for displacement process. (*See* Qs. 1680 and 1732-3.)

1702. It looks like it on the figures that you have given, because, supposing you used absolutely pure alcohol, there would no doubt have to be pretty constant supervision?—Yes.

1703. For that you would have to pay, and it might run into say £300 or £400 a year?—Yes, it might.

1704. Now, let us assume for a moment that it amounted to £400 a year, that would hardly pay you, I gather?—No, it would not pay us.

1705. The cost of the methylated spirit is less than that? Yes. The only way in which the provision in the Finance Act of 1902 might apply in the event of our using duty-free alcohol would be to obviate the drying process. That would save a very large expense. But at present our factory is not designed for carrying it out, as we have always looked upon it as an unattainable thing.

1706. Supposing you were to use duty-free alcohol for that, could you so far separate it from the other processes in which you are using methylated spirit as to be able to confine the supervision to that particular process and avoid extending it to the whole factory?—Yes. In all explosive works all the different processes are isolated processes, and you confine any material that you are using to one or two buildings.

1707. You would probably have to erect new and special buildings, and the supervision might be limited to those?—Yes. I may say that this question of the use of alcohol to obviate the drying process, though it would be important to us, would be vastly more important to the large makers of military powders, and I should think would be of immense importance to the Government.

1708. Do you not do much in the way of military powders?—We do it spasmodically.

1709. Not regularly?—No. We do it when we get an order.

Necessity for recovering spirit.

1710. In the last paragraph of your *précis* you say, "In order to realise the full benefit from any relaxation on the supply of duty-free alcohol, it would be necessary in this explosives industry that permission should be given for the recovery of the spirit, that is the redistillation after its use from the explosive." Why more so with duty-free spirit than with methylated spirit?—No more at all. We have no difficulty at all in that. We pay 10s. for a still licence, and have permission to recover.

1711. That merely means that it would not do to give you the right to use duty-free alcohol, unless you retained also the right to recover as much as you could, and to use it again?—Yes.

1712. Has the question of alcohol engaged the attention of the management of the company much?—No, not very seriously. I looked into the question when it came before the Society of Chemical Industry in 1887, and since then I have simply acted through the council of that society, which has taken a lead in bringing the case of the manufacturers before this department.

Quality of Methylated Spirit–improvement in recent years.

1713. Have you found any change in the course of your experience as regards the quality of methylated spirit; have you found it easier of late years to get as pure a spirit as you require?—We get a much better spirit now than we used to get. I take it that we have educated the methylators up to the fact that we must have it.

1714. From about what period does that date?—It has been a very slow transition, but I should say that within the last six or seven years we have had better spirit than we had ten or fifteen years ago.

1715. In those days did the impurity of the methylated spirit cause you much difficulty?—Yes, it was more noticeable then.

Free use of pure alcohol would ensure

1716. (*Mr. Scott-Montagu.*) Besides the saving that there would be from the use of alcohol in the drying pro-

Cheapness of production with minimum danger in process of manufacture.

cess, the alcohol would obviate a real risk of danger which now exists ?—It would do away with the most dangerous operation on the works.

1717. And would thereby relieve any firm manufacturing powder from a certain amount of liability to compensate workmen and from a certain amount of liability with regard to fire and explosions ?—Yes, it would.

1718. So there would be more saving from the use of alcohol than would absolutely appear from simply comparing exact manufacturing costs ?—Yes. Then, I think, there is one point which perhaps does not enter into the question of economy at all, but it is a very considerable point in the view of the powder-maker; that is, the great saving that there would be in the nervous tension of all those engaged in the works if they knew that a dangerous operation was done away with.

1719. Our competitors have that advantage to-day ?—The Germans have.

1720. And, I think the Belgians ?—I think the Belgians too. The Americans are just beginning to have it.

1721. In those countries, alcohol, having no surtax upon it, and being produced more or less freely in the country, is sold at a very much lower price ?—Yes, I believe it is very much lower.

1722. I think I am not exaggerating when I say that the price is sometimes as low as 8d. ?—Yes, and I believe it falls even lower than that sometimes.

1723. But 8d. might be taken as an average manufacturing price, might it ?—I should think so.

1724. These foreign competitors, therefore, not only save in risk and in manufacturing cost, but they are saving to-day even over what would be your saving if you had duty-free alcohol in this country, because they get alcohol even cheaper than you can get pure alcohol now ?—Yes.

1725. The difference between, say, 8d. and 1s. 5d. is, of course, very considerable ?—Yes.

1726. You have looked into the question of the relief under the Act of 1902, I think ?—Yes.

1727. And you do not see your way really to use it ?—Not with our present works.

1728. But if you had to choose between the two operations, I take it you would rather use alcohol for the drying process than for the hardening process ?—I say that for making our own bulky nitro-compounds I doubt whether the alcohol-substitution of water would be of very much advantage to us; but when we are making the condensed powders, it would make a very great difference.

1729. Altogether you would welcome a change, if a change could be made without danger to the Revenue, in the state of things whereby you cannot get pure alcohol, except under the restriction of having an officer on the premises and expensive regulations of that kind ?—Yes.

1730. It would tend towards the cheaper production of explosives ?—It would.

1731. And it would tend especially towards the production of explosives in a safer way ?—Yes.

The displacement process (*See* Q. 1701–9.)

1732. (*Mr. Nicholson.*) If you were allowed to use duty-free alcohol in this drying process of which you are speaking, and for which your buildings, as I understand you, are not at present adapted, would it be worth your while to make the necessary expenditure to adapt your buildings ?—Yes. The necessary alteration would be very little; it would be practically more the substitution of different forms of plant than of the buildings themselves. There are always on an explosive works available buildings for almost any process.

1733. Would it be worth your while to make the necessary capital expenditure ?—Yes, it would be.

Cheapness of spirit in Germany. State aid.

1734. You were asked just now about the price of spirits in Germany, and 8d. was spoken of as being an average price; are you aware that that 8d. is a price which is below the cost of manufacture ?—I only took the figure that I saw quoted in the foreign chemical manufacturers' reports. I know nothing of the manufacturers' cost price in Germany.

1735. What I was coming to was this—that we could hardly hope to get a spirit at that price under any circumstances in England, because it is below the cost of manufacturing ?—Yes. I take it that it is a lower price than we could produce it at in England.

1736. Although they are using a more expensive material to manufacture their spirits from ?—Yes.

1737. Therefore, alcohol produced in Germany is sold below its proper cost ?—Yes.

1738. So that we could hardly hope in this country to get alcohol at 8d. per gallon, unless it was state-aided ?—No, we could not. I think that we fully understand that.

Cost of acetone (*See* Qs. 1677–8) and alcohol-ether compared.

1739. You mentioned that you used acetone in preference to an alcohol mixed with a certain proportion of methyl in making powder for military purposes, because it was cheaper; can you tell us what the price of acetone is, and how it would compare with the price of alcohol ?—The present price of acetone is extraordinarily high. Its present price is quoted to-day at from £75 to £80 per ton, and its normal price is £50 or under. But the comparison is not between acetone and alcohol; it is between acetone and the alcohol-ether mixture. The price of the alcohol-ether mixture is considerably higher than the normal price of acetone pure and simple.

1740. So that the amelioration of a few pence per gallon would probably not induce you to give up acetone ?—Anything that would bring the price of alcohol-ether down to the price of acetone would enable us to use it, because alcohol-ether is a better material to use for many purposes.

1741. By what would it be necessary to reduce its price in order to enable it to compete with acetone ?—That would require a little calculation, but I should think that a reduction of 6d. per gallon on the alcohol would bring the mixture down to about the normal price of acetone.

1742. (*Dr. Thorpe.*) What is the actual price per gallon of acetone to-day ?—Its present price to-day I think you may take at the lowest to be about £75 per ton.

1743. Let us have it in gallons, if you can, because then we can compare it with what we know to be the cost of wood-naphtha, and with what we know to be the cost of alcohol. £75 per ton would be about 4s. or 4s. 6d. per gallon, would it not—I am only speaking from memory, but I have the figures somewhere of what the cost of acetone is ?—Acetone runs about eight and a half pounds to the gallon, so that it would work out to about 4s. at its normal price.

1744. Can you tell us what is the market price of methylated ether to-day ?—Ether to-day is 7½d. per pound, and there are seven and a half pounds of it to the gallon.

1745. So that a gallon would be about 4s. 6d. ?—Yes.

1746. What is the price of spirit 66 o.p. ?—1s. 11d. per gallon *i.e.*, methylated.

1747. (*Chairman.*) Do you use 50 per cent. of each ?—No; for the alcohol-ether we use 60 to 65 per cent. of ether.

1748. (*Dr. Thorpe.*) May we say that of that mixture six tenths is ether and four-tenths alcohol ?—Yes. At its present price ether is rather cheaper than acetone, but as in the mixtures we use 60 to 65 per cent. of ether, but we should only use 40 per cent. of acetone, it results that the acetone mixture is really cheaper.

1749. (*Mr. Scott-Montagu.*) What would be the actual saving—presuming there is a saving—in using pure alcohol ?—Pure alcohol at 6d. per gallon less than methylated spirit at 1s. 11d. works out on the ordinary price of acetone as rather a saving, though there is very little difference. It is more a question of choosing the better material.

Methylated spirit in the hardening process. (Q. 1665–7, 1690–1).

1750. (*Dr. Thorpe.*) The price of ether follows the price of alcohol, does it not—the two run together ?—Yes.

1751. If you have cheap alcohol you have cheap ether ?—Yes.

Relative inferiority of ordinary quality an empiric fact, even though not explicable on chemical grounds.

1752. What were the particular ingredients you sought to get rid of when you asked for this special wood naphtha to be added to your spirit ?—What we sought to get rid of were the unknown ingredients in wood naphtha.

1753. What are the ingredients that you think are unknown ?—It is very difficult to say exactly what they are without very careful analysis. We go not by the analysis of the spirit, but by its action on the nitro-

Mr. R. W. S. Griffith.

30 Nov. 1904.

compound. We have always tested the purity of our wood naphtha or methylated spirit by its action on the nitro-compound; the purer it is, the less it reduces the heat test.

1754. Purity, of course, is a relative term. What I want to get at if I can is, what were the things that you sought to get rid of, when you applied to the methylator to give you a specially good character of wood naphtha, which thereby enhanced the price of your methylated spirit—because you told us that is what happened; you said that the increase in the price was due to the special wood naphtha that you wanted?—Yes.

1755. At all events, you thought you were getting rid of something, and I should like to know what it was you thought you were getting rid of?—We were hoping to get rid of any possibility of the impurities that are found in any impure wood naphtha. I do not know in the least what the ordinary wood naphtha may be.

1756. Let us thresh it out. Would any quantity of acetone in your wood naphtha be detrimental to you?—No, not pure acetone.

1757. Between seven-tenths and eight-tenths of the ordinary wood naphtha which is required for methylation is methyl-alcohol, and about twelve parts or rather less in 100 is acetone?—Yes, just so.

1758. Now we have accounted for something over 80 per cent. of the material?—Yes.

1759. What are the other things that you imagine are in wood naphtha?—There might be some pyroligneous acid in wood naphtha.

1760. Pardon me, there is no pyroligneous acid, but there is a slight quantity of acetate of methyl?—Might there not be some allyl alcohol?

1761. There is acetate of methyl and there is a compound known as acetal. There are more acetones than the ordinary acetone—for example, methyl-ethyl ketone—all of them perfectly neutral bodies and all of them, so far as I know, not detrimental to your processes. What can there be in the wood naphtha which requires you to make this difference in the cost? What you have done in insisting upon this high-class character of wood naphtha is to ask for a type of methyl-alcohol with a minimum quantity of acetone in it—and the acetone is what you say you would not really object to. But that is what you have secured?—I can only say that in actual experience we have had samples of methylated spirit which did reduce the purity test of the nitro-compound very much more than other samples.

1762. Of course, you would have also small quantities of pyridine and nitrogenous bases of that character; they are there in very small quantities indeed, nevertheless they confer upon the wood naphtha its characteristic nauseous quality, but they are in no larger quantity than the volatile ethers, we will say, that give the bouquet to wine and differentiate one wine from another, though the amounts of them are almost in some cases imponderable and can only be picked up by a sensitive palate. The pyridine and those nitrogenous bases are only present in relatively small extent?—Yes, that I understand.

1763. Can those things exercise a hurtful influence?—I can only say that there is something in some samples of methylated spirit that does reduce the purity test; whether it be some other ketones than acetone I cannot say. Pure acetone has no effect that way.

1764. Are you quite sure in your own mind that it has paid you to get this extra good quality of wood naphtha introduced into your methylated spirit?—It has quite paid us in peace of mind, knowing that our samples will stand without deterioration, which we had had difficulty about and had found had not been the case formerly.

Displacement process for condensed powders. (Qs. 1679-82.)

1765. Now let us turn to the other matter, namely, the substitution—for such I gather it is—of the water in the damp nitro-compounds by means of alcohol; that is what you want to do, is it not—you want to take away water, and to put in its place alcohol?—Yes.

Unsuitability of Methylated spirit.

1766. With a view of being able, I gather, to dry it at a rather lower temperature than you otherwise would be able to?—It can either be dried at a lower temperature or, what is more preferable, you can use the alcohol-moistened nitro-compound by putting it at once into the mixers with its proportion of acetone or ether, so that the alcohol that is used for the displacement shall be part of the ingredients for the next process.

Experimentally established.

1767. You do not actually dry it?—No, I should not recommend the drying.

1768. You displace the water by alcohol and then you use the mixture so damped out, if I may call it, with alcohol in a subsequent operation?—Yes.

1769. And you say methylated spirit would not do for that?—No. It may be unfounded, but we certainly have a dread of using more methylated spirit than we can help.

1770. Have you actually tried to use methylated spirit in this connection?—Yes.

1771. Did it not succeed?—Methylated spirit does not make as good an alcohol-ether powder as pure alcohol and ether does.

1772. For this special case why could you not displace the water by methylated spirit, because you subsequently do use, I understand, the methylated spirit, by adding the powder so partially dried to a solution containing methylated spirit?—Yes, for the "bulky" nitro-compounds, but not for condensed powders.

1773. What is the objection to displacing your water with methylated spirit?—None, for that purpose of displacement. I would quite as soon use methylated spirit for the purpose of displacement.

1774. That is the point. You told me you wanted the alcohol to drive out the water, or practically to displace the water?—That is so.

1775. Then you told me that when you have displaced it with pure alcohol, you add to it a mixture containing methylated spirit?—Yes, as regards the "bulky" nitro-compounds.

1776. Why not displace the water with methylated spirit, then?—We have to do with two different classes of powder. That is quite feasible with the ordinary bulky sporting powders, but methylated spirit does not produce the same character of grain in a condensed powder as pure alcohol does.

1777. I thought I had confined myself to that particular case where you said you required to displace water by means of pure alcohol?—You can do that for either powder, and in our so-called bulky powders which are only partially dissolved and not totally dissolved in the solvent, the action of the methylated spirit would not be objectionable. But in the making of condensed powders, which are totally dissolved nitro-compounds, there is a difference in the grain after the powder is rolled and flaked; and you cannot control the surface of the grain with a methylated-ether mixture in the same way that you can with a pure alcohol-ether.

1778. I am anxious to meet you and to get at the facts. Let me be quite clear in my mind what it is you do. You take this damp nitro-compound and you wish to get rid of the water in it; you therefore ask to be allowed to use pure alcohol for that purpose. Then having the nitro-compound saturated with the alcohol, you add it to something else?—Yes.

1779. You add it to a mixture of methylated spirit and acetones, is that not so?—Yes, in the one case.

1780. In the particular case we are talking of, namely, these condensed powders?—In the case of the condensed powders we should add it to a mixture of pure alcohol and ether.

1781. Could you not use methylated ether?—That does not make a good powder.

1782. At present do you use pure alcohol and ether?—No, we do not use that process at all.

1783. But you desire to use it?—We desire to use it.

1784. You say you can only use that process if you have pure alcohol to displace the water, and pure alcohol to mix with pure ether?—To make the final solution, yes.

Pure alcohol not a necessity in making bulky sporting powders.

1785. (*Chairman.*) Are we to gather from what you have said to Dr. Thorpe that if you are manufacturing your heavy powders, then in that case the alcohol which you use for drying the nitro-compounds need not be pure?—

We should require that to be pure. In making the condensed powders we want to use the pure alcohol all through.

1786. And when making a bulky powder ?—When making a bulky powder the use of pure alcohol all through is not so necessary.

1787. And it is not necessary even for the particular purpose of drying the nitro-compound ?—No, it is not so essential, though it is rather desirable.

1788. Therefore, for what is the major part of your present business, pure alcohol cannot be said to be a necessity ?—No, it is not a necessity.

The displacement process (Q. 1576, etc.) Suggested alternatives to use of alcohol.

1789. (*Dr. Thorpe.*) May I again come back to this question ? One of your objects is to get rid of the water, and you wish to displace that by means of the alcohol; cannot you get rid of the water by some other way ?—Yes, by drying.

1790. That you object to ; is it because of the elevation of temperature ?—Yes ; it is a dangerous operation.

1791. Cannot you get that by a reduction of pressure ?—In vacuo ?

1792. In a partial vacuum ?—We object very much to vacuums for explosives.

1793. Why ?—Because the explosives would then be in a confined vessel, and in case of any accident occurring in a confined vessel, the results are very much more serious.

1794. For example, it would not suit your purpose and it would be a thing you would object to, and would decline to do, to place this damp material under such conditions that you could evacuate the air over it even at a low temperature, and get rid of the moisture in that way ?—Yes, we should object.

1795. Do you centrifuge this stuff at all ?—Yes.

1796. You do put the damp stuff into a centrifugal machine ?—Yes.

1797. How much water is left in then ?—About 40 per cent.

1798. Cannot you get it dryer than that by centrifuging ?—No. I do not know whether you wish me to speak on the point, what other material the spirit could be denatured with for our purpose ? We could use it for our two distinct processes, either denatured with a certain percentage of acetone or with a certain percentage of ether.

Question of a suitable denaturant in lieu of wood spirit. Acetone (*see also* Qs. 1814–1815, 1823) or ether (*see also* Qs. 1812–1813).

1799. (*Mr. Scott-Montagu.*) Supposing, for the sake of argument, the Inland Revenue authorities were to allow you, would you like to dilute your alcohol with some other substance more suitable to the manufacture of your product ?—Yes.

1800. (*Chairman.*) And could you conveniently do that without injury to the efficiency of the alcohol by some simple process, such as the use of camphor ?—No, but we could by acetone. We do use camphor occasionally, but in very small quantities. For the two distinct classes of powder we make, it could be denatured either with acetone or with ether.

1801. (*Dr. Thorpe.*) Supposing a small quantity of some volatile hydro-carbon were added, would that be admissible ?—If we could get an inodorous one, but we very much object to anything that leaves a benzeny or paraffin smell in it.

1802. Supposing you could get a thing like petroleum ?—Providing we can get rid of the smell it would be admissible ; but the smell of petroleum is much more tenacious than even the smell of methyl alcohol.

1803. Of course, you can get a light petroleum which practically leaves no smell ?—Yes.

1804. (*Mr. Scott-Montagu.*) Have you tried the feasibility of making an application to the Board of Inland Revenue to allow you to methylate with any other substance than methyl alcohol ?—No ; I have not thought of it till this.

Excise supervision necessary with specially denatured spirit.

1805. (*Chairman.*) Assuming that you were allowed to use some process of denaturing, do you think it would still be necessary for the Excise officer to be in constant attendance in order to see to the issues of the denatured spirit ?—No.

1806. How often, and in what sort of quantities, would you require the denatured spirit to be put at your disposal ?—We are continually using it, night and day ; we are drawing it from the reservoirs.

1807. If the spirit came on to your premises in a perfectly pure state, and there had to be denatured, the first thing would be that it would have to go into a locked store under a Revenue lock, it would then have, either there or in an immediately adjoining compartment, to be subjected to this process of denaturing, and then the spirit would only be issued to you as and when you wanted to use it. If your supply which is in use in the factories required to be constantly replenished, that would almost mean that the Excise officer would have to be there constantly when you wanted him ?—Exactly.

1808. Therefore using a satisfactory process of denaturing is not a substitute for the special supervision ; it may diminish it, but you would still be obliged to have a considerable amount of supervision, though it might not cost so much as the figure I mentioned before, namely, £400 per year. Would supervision be an advantage to you for your own purposes and for your own interests, in order to protect you against the misuse of this spirit by your own workmen ?—No.

1809. You would not care for it from that point of view ?—No, not from that point of view at all.

Little risk of misuse of spirit in manufacture of explosives.

1810. As a matter of fact, if the spirit was used from first to last in a pure state, would there be any particular opportunities for your workmen to embezzle it ?—No, I think not. Our explosives men are always under supervision, and are always being searched.

1811. (*Dr. Thorpe.*) How many men do you employ at your works ?—At our main works we have about one hundred, and at another works fifty. At present one of our works is not doing anything.

1812. A mixture of alcohol and ether is not necessarily any protection, is it ?—No, none whatever ; I am quite aware of that.

1813. If you put such a mixture forward as a suitable denaturing agent, what attitude do you think the Board of Inland Revenue would take up ?—I am quite aware that that is no preventive against its being drunk.

1814. Have you anything more practical to suggest ?—No, except that I think a good dose of acetone would prevent its free use.

1815. Acetone is within the bounds of practical politics ?—Yes.

No difficulty in protecting interests of the Revenue.

1816. (*Mr. Scott-Montagu.*) Following up the Chairman's suggestions, it would be possible, would it not, for the pure alcohol to be kept in one locked chamber or house, and for a mixing receptacle of some sort to be adjoining, so that the Inland Revenue officer could come up once a week, or even if necessary twice a week, but once a week I should assume would be quite enough—and watch the process of mixing and assure himself that it was denatured ; and then for you to use it afterwards in the way in which you are now using your denatured spirit ?—Yes, providing a sufficient quantity were passed at a time.

1817. That would only be a question of having a sufficiently large tank for mixing, and of having a reserve in that way ?—Yes.

1818. There would not be any practical difficulty in that, would there ?—No.

1819. (*Chairman.*) Can you tell us what would be your probable week's supply ?—We ought to have 300 to 400 gallons available for the week—not necessarily that it would all be used, but our consumption varies a good deal—for one thing it varies with our recovery, of course, and that varies somewhat.

1820. (*Mr. Nicholson.*) Would that be under the control of more than one man ?—It would be under the control of one man only.

1821. Practically secured by your own lock ?—Yes. One man has charge now of the spirit store, and serves out the spirit only as it is wanted.

1822. (*Mr. Scott-Montagu.*) Supposing you were in the position of an Inland Revenue officer—I know of course that you wish to protect their interests as well

Mr. R. W. S. Griffith.

30 Nov. 1904.

as to forward the interests of your company—looking at it quite fairly and impartially, do you anticipate that there would be any difficulty in protecting the revenue, if some such process as I have suggested were carried out?—I think not in our case; I see no difficulty in it whatever

1823. (*Chairman.*) Would the spirit mixed with acetone be very nauseous?—I should think so, but I have never tried it.

1824. (*Mr. Nicholson.*) Of course, you could keep books showing the issues and produce them to the officer if necessary?—Yes. We do now. I do not know whether it is owing to our having a spirit store, but we have to keep books showing the quantity brought into the works and the quantity used.

1825. (*Mr. Scott-Montagu.*) You have never had any difficulty with the Inland Revenue authorities, have you, about your methylation?—No.

1826. Nor about the recovery of your ether and alcohol?—No.

1827. (*Dr. Thorpe.*) What is the amount of methylated spirit that you are allowed to use in the year?—We have taken the largest bond and I think we can use any quantity. We are using about 6,000 gallons a year now; and I think it is a bond for £1,000 that we have entered into.

1828. (*Chairman.*) Do you not use more than 6,000 gallons in the year?—No.

Mr. WILLIAM HENRY BAGLEY, called; and Examined.

Mr. W. H. Bagley.

30 Nov. 1904.

1829. (*Chairman.*) You, I think, are one of the nominees of the Birmingham Chamber of Commerce?—Yes.

1830. You represent the firm of Samuel Heath & Sons, Limited, Birmingham?—Yes.

1831. What is their business?—We are general stamp brass founders. I believe we are the largest in the world. We have something like eleven departments, and we make all sorts of fancy goods, brass parts for bedsteads, and so on.

1832. Your interest in the matter that is before the Committee is as users of lacquer?—Yes.

1833. Not as makers of lacquer?—No.

Lacquers. Superiority of those made with pure spirit as regards lasting qualities,

1834. As users, you have formed the opinion that lacquer made from pure spirit is better than lacquer made from methylated spirit?—Undoubtedly.

1835. How do you arrive at that conclusion?—By its lasting properties, for one thing.

1836. There is no such thing as lacquer made from pure spirit in this country, is there?—We buy it on that supposition. We have paid as much as 32s. a gallon for it, in place of lacquer that we use regularly, costing 4s.

1837. Have you used any large quantity of that?—No, we cannot afford to. It is only in very exceptional cases, such as some very high-class article, that we should use a pure spirit lacquer. We have used it for special sets of bedstead mounts; for instance, Peytons' or Hoskins & Sewells' may mount a bedstead for an Indian prince or something of that sort, and then everything of the very best has to be used.

1838. Has this pure spirit lacquer to be made specially for you?—I really cannot tell you whether it is made specially, but we buy it from the lacquer maker and it is guaranteed pure.

1839. Is it guaranteed to be pure duty-paid spirit lacquer?—Yes.

1840. I cannot help thinking that they must only make it on your order?—Frobbaly. We should not order more than perhaps a quart or half a gallon at the very outside.

and appearance.

1841. When you get that class of lacquer, you find what differences as compared with the ordinary lacquer?—The deposit is clearer. We obtain what we consider a very much finer finish, as far as the appearance is concerned. We have had a very wide experience, I can assure you; I do not think there is any lacquer maker in the Kingdom really that has not supplied us, because we are very large users indeed, and everybody caters for our trade. All methylated spirit lacquer, that is to say, commercial lacquer, as we understand it, costing anything between 3s. 3d. for pale shell up to double gum lacquer at about 6s. 6d., which we understand to be made from methylated spirit, leaves a certain iridescence, which anyone who is used to lacquering can detect in an instant. I do not know whether any experts are present, but an ordinary layman would not be able to detect that at once, though I should say a man used to the business could detect it in an instant. I have a sample in my pocket now of a pure spirit lacquer and a sample of a methylated spirit lacquer, but you could not detect the difference by this light, I think.

1842. (*Mr. Scott-Montagu.*) Give us a chance, let us see it?—(*Producing samples*) These three articles were taken out of a box of ten or fifteen gross quite by chance. They were the first three I picked up. We had a sample of wood naphtha lacquer made, wood naphtha, we understand, being the basis of methylating. We are not chemists, and we do not understand these things. There was something said, I believe, by you in your letter which Mr. Barlow showed us, asking for reactionary agents and all that sort of thing. I could not tell you anything about that, and I do not suppose he is much more of a chemist than I am. "What is the basis of this sophistication or denaturing," I asked? "Wood naphtha." I said, "Well, if that is so, make us a lacquer from this wood naphtha and we will see what the result is." The result is a dull, woolly, obscured finish.

1843. (*Chairman.*) Is the lacquer used in *this* specimen made from wood naphtha only, and not from methylated spirit?—That is made from wood naphtha only. I daresay Mr. Barlow will tell you the cost of that experiment. This second specimen was lacquered with a pure spirit lacquer, and this third specimen was lacquered with a methylated spirit lacquer. If you concentrate the light—you will not get the effect by this light—you will see an iridescence in the methylated spirit lacquer. We contend, and in fact it is our experience, that that peculiarity, as Professor Frankland suggests, is caused by the unequal depositing of the gum. That peculiar iridescence which I cannot otherwise explain, is not present in the pure spirit lacquer; why, Professor Frankland cannot tell. He thinks the iridescence is due to the wood naphtha or to the mineralised naphtha.

1844. (*Mr. Scott-Montagu.*) Does it really make much difference?—Any lacquer with that iridescence in it seems to perish. The lasting power of a pure spirit lacquer—and we have tested it very exhaustively—is considerably greater than that of a methylated spirit lacquer.

1845. (*Chairman.*) It is a very fine distinction, I must say, looking at the samples here. You made a remark just now which I think is interesting to us—namely, that Professor Frankland had told you that he was not sure whether it was due to the wood naphtha or to the mineralised naphtha?—Yes, he used the term "mineralised." He is a professor at the Birmingham University.

1846. As a matter of fact, I believe people do not use the mineralised methylated spirit for the manufacturing of varnish or lacquer?—I may tell you that perhaps in introducing Professor Frankland's name I have been a little too previous. He is engaged in experiments at the present time, and he has reached no stage yet where he can give us any information.

1847. That is really what seems to me to be wanted; it seems rather that we do want further examination. It is difficult for the Committee to pronuounce an opinion at the moment on the fact whether it is really the methylation of the spirit, or what is in the methylation, that produces this very slight difference?—The point that I wish to establish is this—that from experience we say that a pure spirit lacquer such as we have used for special purposes, and for which we paid an enormous price, is infinitely better for all purposes naturally than a methylated spirit lacquer.

1848. Is not that rather a strong expression?—It lasts very much longer.

1849. That is another matter, but as far as the appearance of the thing goes, even you had to go to the window

before you could tell us which was which ?—But you keep that in stock for a little time, and note the result. There seems to be an acidity in a methylated spirit lacquer which seems to affect the surface of the metal. That is really a bad sample to convince you of the difference in appearance. If you were to take a flat surface, which I really ought to have brought up with me, you would see a little difference quite perceptible even now. In these articles, to me or to a man who is constantly using them, a difference in the finish can be detected. You think it is a very fine distinction, but fine distinctions are big distinctions with us.

1850. Of course it is a more important distinction if the one loses its brightness in a short time and the other does not; but at first starting, the distinction, I must say, does not appear to me to be of first-rate importance ?—I can quite understand that; it is not so apparent to you as it would be to us. But when it comes to a question of a bedstead seller exhibiting his wares in the street, at all events you will see how very badly they would go in a little time if the lacquer used were a methylated spirit lacquer, but if a pure spirit lacquer were used on them they would stand considerably longer.

Cost of methylating: Its effect on the cost of lacquers.

1851. That is as regards the quality of lacquer made. Now as regards the price on the score of economy, I understand you consider that if the spirit had not been methylated you would be saved a considerable sum by eliminating the cost of methylation ?—Yes.

1852. And that you put in your *précis* at between £150 and £250 a year ?—Yes, that is according to the state of the trade; but the minimum saving we have considered would be £150 a year.

1853. What is the basis on which you calculate that—a difference of price per gallon in your lacquer of what ?—Of about 1s.; it is in fact a little over 11¼d.

German lacquered goods said to be better than English. Superiority attributed to quality of lacquer, not to different process of application. (*See also* Qs. 1870–85, and 1882–5.)

1854. Then I see you use from about 3,000 gallons to 5,000 gallons a year of lacquer ?—Yes, about that; and if we had only to pay the same for the pure spirit lacquer we contend that not only should we have a very much better finish to our goods, but that it would certainly help us considerably with our foreign trade. It is a matter of general complaint that our stuff does not carry well, if you understand that term. We compare unfavourably, I can assure you from observations which I have constantly made in Germany amongst our competitors' goods; in similar classes of goods our finish does compare unfavourably with the German finish. I state that emphatically.

1855. Are you sure that the German lacquer is made with pure spirit ?—I am not sure. It is only what was stated to me from investigations on the spot, but I have not been over there since this inquiry was instituted. The German lacquer has not the smell of methylated spirits. I have smelt it, and as far as I could tell it was a pure spirit. It certainly leaves a brighter, glossier finish than our lacquer does. I had some specimens by me at one time which I brought back, but I have not them, unfortunately, now. I made some experiments. They lacquer on a different principle to ours. We have tried their method. They lacquer their articles individually over a Bunsen flame. Ours are lacquered on a hot stove as large as this table, which is heated underneath with Bunsen burners. On each individual piece, the lacquer is applied by machinery or otherwise; we have rotary machines which are patents of our own. In Germany they hold each piece over the Bunsen flame itself; and the lacquer is applied afterwards in the same way that it is by us, that is to say, they have the usual lacquer bowl which is a basin sunk in a block of plaster of Paris which is kept there to prevent any undue evaporation, and there is a wire stretched across for scraping the brush.

1856. Are you satisfied that the difference between the appearance of British and of German lacquer work may not be attributable to the difference in the process of lacquering rather than to the lacquer itself ?—I have tried the experiment, and we did not get any different effect to what we already had, so we put it down to the lacquer.

1857. (*Dr. Thorpe.*) You have not had the opportunity of trying the experiment of giving a German lacquerer your material to use ?—No, but the process is precisely the same. I do not think it could possibly affect it, because there is the lacquer in a basin, and there is a camel hair brush of a certain gauge, and I cannot see that it makes the slightest difference.

1858. The method of applying the heat might make the difference ?—We have tried their method of applying the heat. We have had a Bunsen burner stripped, and we have put the article over the Bunsen flame. They work by knack, pure and simple, and we work by a dead regulated heat. Of course, you can apply the article over a Bunsen flame and get it red hot. They simply put the article over the Bunsen flame until it dews and then dries. The moment that the damp disappears then the heat is sufficient Therefore I think it is purely knack; you will understand the term.

1859. That knack, perhaps, is part of what contributes to their success ?—But then we work with a scientific heat, which is proved to be the correct heat. We do not work by any chance method of that sort.

Impotability of lacquer whether made from pure or methylated spirit.

1860. (*Chairman.*) As regards the lacquer itself when it gets into your works, of course it is really a matter of indifference as to whether it is made from methylated spirit or whether it is made from pure spirit as regards any temptation which it might afford to your operatives to drink it; in either case the lacquer is undrinkable, I suppose? —In my opinion I go this far—I regard the lacquer in its present form, or in any form, as a poison, and I consider it ought to be brought under the Pharmacy Act. I believe we ought to be compelled, and I say that it would be a very wise thing to compel us, to label every utensil "Poison." That is, if the verdict goes for us—if it is a verdict for the prosecution; I do not know whether you are the defence or not.

1861. I have referred to that because you refer to it in your *précis*, but it seems to me that it is really not a point we need trouble about, because anyone who would drink one lacquer would probably drink the other, and the probabilities are that there is not much chance of anybody drinking either; so that the purity of the spirit which was employed in making the lacquer does not affect that side of the question ?—I do not think it affects that side of the question in the slightest degree, I have not taken count lately, but I should think we employ somewhere about 100 to 120 lacquerers for the final processes, barring wrapping up, and these girls would no more dream of drinking lacquer than they would of getting a handful of arsenic or anything of that sort and eating it. We employ deadly poisons of different sorts in many of our processes, and if a man wants to commit suicide, believe me, he can commit suicide in fourteen or fifteen distinct ways in our works.

1862. What are those specimen bottles that you have placed on the table ?—In regard to the point that you raised about the reactionary spirit, and so on, looking upon ourselves as the man in the street, without any technical knowledge, we asked first of all, what is a pure spirit and what is a methylated spirit ?—We were supplied with samples of the two, and here they are. The pure spirit is as pure as crystal. It is hardly necessary for me to emphasize the point that the process of lacquering is purely a matter of the evaporation of the spirit and of the deposit of the gums. If there is any free matter in the spirit, that must be deposited with the gum, to the detriment of the article. It does not require any chemical mind or any specialist's mind to see the difference between those two spirits. One is absolutely pure, and it is as clear as crystal; the other contains free matter, although I am told that the methylated spirit in it has been subject to a double filtration. That stood on my desk for twenty-four hours and there was a slight tinge of brown deposit, and on shaking it up—even without shaking it up—free matter could still be seen in the methylated spirit. I say as a matter of common sense that we are not only paying a shilling a gallon for what is to us a perfectly useless and deleterious article, but we are also using a matter which militates against the finish of the thing, and which we do not require at all. If you take those bottles to the window and look down, you will see at once the difference in the colour of the two—it is so patent—so apparent.

1863. I think that sort of evidence had better come from a maker of the lacquer rather than from a user of the lacquer. Practically it comes to this, that the Committee may understand that you, with your experience as a user of lacquer, are perfectly convinced in your mind that lacquer made with pure spirit is more suitable for your

Mr. W. H. Bagley.

30 Nov. 1904.

purpose than lacquer made with methylated spirit?—Absolutely.

Pure-spirit lacquer. Its purchase at a high price for special purposes adduced as a proof of its superiority.

1864. But you are not able to give the Committee any reason in support of that. That conclusion that you have drawn, is drawn solely from your own experience as practical users of lacquer, and you are not able to suggest any reason why the one lacquer should necessarily be better than the other?—No, but I put it to you as a counter proposition—would any manufacturer, if the two lacquers stood on the same basis from a usable point of view, be quite so foolish as to pay 32s. for a lacquer when he could get a lacquer that would answer equally well for 4s. 6d. or 5s.? I say that, with all the years of experience behind us that we have.

1865. I quite admit that that is a strong argument in support of the strength of your conviction, but I also understand that your pure spirit lacquer is not a thing that you use very often?—No, we could not afford to do so.

Insulation lacquer.

1866. You would not advise a client to make such a specification as would require you to use it?—No. We have an electrical department now, and I am afraid I do not know much about that department from a technical point of view. In electrical work, where insulation is a factor, they have to use a pure spirit lacquer, because, I believe that in insulated work it is highly necessary, in fact it is specified that a pure spirit lacquer should be used.

1867. (*Dr. Thorpe.*) Have you got a specimen of the actual lacquer with you?—I think Mr. Barlow has specimens of the lacquers.

1868. So that we should be able to compare the character of the lacquer with specimens of the spirit that you have submitted?—Yes.

1869. (*Chairman.*) Do you know how far the view that is held by your firm as regards lacquer made from methylated spirit is commonly held by other users of lacquer?—I have a number of letters from some of the leading firms in Birmingham, confirming my views absolutely upon that point.

English and foreign lacquers compared. (*See* Qs. 1854–9 and 1882–5).

1870. (*Dr. Thorpe.*) You are anxious to save from £150 to £250 a year; that is really the point of what you have brought before us?—We divide our position into (*a*) and (*b*)—(*a*) the economical effect, and (*b*) most certainly—and I most strongly emphasise that—the quality of the finish. I am practically the only one in the firm who can speak with authority upon the point. I have been abroad—I have been all over the world pretty well—and have studied the question from that standpoint, a great deal more than I have from the economical standpoint; in fact I have only tackled it from the economical point of view within the last few weeks. I have given you the comparative finish between our firm's goods and those we have to compete with abroad, and I say most emphatically—and I have been threshing out this lacquer question now for years—that we are still where we were, for some unaccountable reason. I have deliberately come to the conclusion that it is a pure spirit lacquer that we want. Everybody says the same thing—that the English goods are bad from a lacquering standpoint.

1871. (*Chairman.*) How do they compare with the French goods?—As far as France is concerned, I do not think 10 per cent. of our goods go over there lacquered at all. They will not have the English lacquer.

1872. Have you compared your goods with the French in this respect?—No, I have not taken samples of the French lacquer, simply because, during the whole of my experience, they will not take English lacquered stuff. They have it over, and mop it up themselves, and lacquer it themselves. All the bedstead makers there, I think, without exception, do their own lacquering.

Conditions of manufacture abroad.

1873. (*Dr. Thorpe.*) The real point is this; what you have got to compete with is one character of denatured spirit against another character of denatured spirit?—That I do not know.

1874. I assure you, that is the fact; that is really what you have got to compete with; and now you are asking to have a perfectly pure alcohol, which is not granted to any lacquerer anywhere?—Why not.

1875. That is another matter?—We want to know why this spirit should be tampered with. Here is a fine spirit practically spoilt for industrial purposes.

1876. Do you say that you are handicapped by foreign competition?—As far as finish is concerned, that is true. Whether they denature it in another way, you, of course, have better information upon than I have; but it is a fact that the English finish does suffer by the lacquer that we use here. I will put it in this way, as rather a reservation: The English made lacquer at all events takes something off the finish of the goods.

1877. But it is quite another proposition to say that nothing else but pure spirit will do for you?—Of course I am only now speaking of experiments we have made with pure spirit lacquer. We contend that the pure spirit lacquer, which we have had opportunities of testing, fulfils its purpose, in other words, leaves all the pristine finish, and that there is no acetate or something else in it which seems to what we call take the flush off.

Successful competition of English lacquered goods in Germany.

1878. (*Chairman.*) On the subject of foreign competition, do you find that the German goods on the market in this country have an advantage over your goods on account of the lacquer?—No. German goods do not come to this country in the particular branch that I am now directing my attention to; but we have a stock in Germany, and employ an agent there and we used to do a large trade there.

1879. By sending your lacquered goods to Germany?—Yes.

1880. Your lacquered goods, on arrival in Germany, are met with a duty, I suppose?—Lacquered or unlacquered, it is the same duty—10 per cent. We compete quite easily with the German manufacturers on the score of price.

1881. In spite of the 10 per cent. duty?—Yes, in spite of the 10 per cent. duty. But I can assure you that we do not in finish, and I am ashamed to say it. Really it is a most serious point.

Foreign lacquered goods. Difference of finish attributed to quality of lacquer. (*See* Qs. 1855–9.)

1882. (*Dr. Thorpe.*) Would you mind telling us what character of persons are employed in lacquering in the German works?—From my own observations I should say 90 per cent. or more are females of the same type that we employ; perhaps a little older on the average, but there is not any very material difference.

1883. They are not more expert, are they—because lacquering is a thing, I suppose, very largely of knack, as you say?—Yes and no, provided that the body of the lacquer is good. You will see a variation in the colour, especially in the double gum lacquer, when you are working up to a colour; it becomes streaky. But that is not the point; the thing is that it takes the brilliancy off the finish; our lacquer seems to take some of the brilliancy, some of the smartness, some of what we call grip, from the article.

1884. And that is not dependent upon the knack of the lacquerer?—I say no. You can easily tell when a bad lacquerer has been at work, because it is all in patches, as she does not get the sweep of the brush right. The thing is to make an even surface of the lacquer on the article. That is all the art of lacquering, believe me; because the heat is scientifically regulated. The mere question of putting an even coat on is all the art that there is.

1885. Does not the iridescence that you speak of really arise eventually from uneven lacquering?—I say no. The same girl lacquered those three specimens that I have produced with three different kinds of lacquer. She can lacquer a thousand of each, and I will guarantee that every one lacquered with the methylated spirit lacquer will show that iridescence—which to me would be quite apparent; and with the pure spirit lacquer you will never see it. I cannot tell you the reason why; do not misunderstand me, nor my position about it. We say it is so in the methylated spirit and it is not so in the pure spirit; and we consider—of course it is only supposition on our part—that it is some sort of acid or something of that sort that seems to disintegrate or break up the lacquer.

Mr. FREDERICK BARLOW, called; and Examined.

1886. (*Chairman.*) You have been nominated by the Birmingham Chamber of Commerce as one of their Representatives on this occasion, I think?—Yes.

1887. You represent the Dalton Manufacturing Company, Manchester, and the Birmingham Lacquer Company, Limited, of Birmingham?—Yes.

1888. Are they separate concerns?—Yes, entirely. As far as the Dalton Manufacturing Company is concerned this inquiry does not interest them at all, because they only make cold lacquers, which are made from fusel oil; but it does concern the Birmingham Lacquer Company, which has only recently been formed for the purpose of making hot lacquer, and it was for that Company that I made application for permission to use pure spirit.

1889. In what capacity are you engaged in connection with the two companies?—I hold all the ordinary shares in the Birmingham Lacquer Company, so that it is practically my own concern; and I have an interest in the other company. As far as the cold lacquer is concerned we are making the best cold lacquer on the market, and we get about 30 per cent. higher prices than any other cold lacquer manufacturer. Some twelve months ago or more I decided to go in for making a hot lacquer which would stand in the same position. It was when I went into the question that I found that this pure spirit would make a better lacquer, if we could only get permission to use it; so I made application for that permission.

Lacquer. Superiority of that made with pure spirit.

1890. You applied to the Department here, did you?—Yes, and I have their reply with me (*producing same*).

1891. I remember that; that was last May?—Yes.

1892. Is your opinion that pure spirit is better than methylated spirit the result of your observation in the way of experience, or is it the result of experiments?—Last May at the Lytham Shipbuilding Yard we were experimenting for exposure with a lacquer made from pure spirit, a lacquer made from methylated spirit, and a lacquer made from fusel oil, adding to each of them an equal quantity of the same quality of shellac. We found that the fusel oil lacquer and the pure spirit lacquer, both of them, stood very much better than the methylated spirit lacquer.

1893. Can you use fusel oil for hot lacquer?—No, we cannot. I will tell you what absolutely prevents the use of cold lacquer for work like a gas-bracket, for instance. Every one of the pieces of which that bracket is composed is lacquered separately. Then they are put together, and in putting them together, there is a certain amount of white lead used in the joints, and a certain amount of screwing up and fixing in vices and so on. All that marks the polish. With a cold lacquer, you can only put one coat on, and although theoretically it is possible to remove the scratch marks carefully and give them a re-coating so that no one would notice it, practically in an ordinary factory that is an impossibility. Consequently they have to use hot lacquer for that kind of work; because then they simply take it when it is put together, put it on the stove, make it warm, brush it over with a brush, and the scratch marks disappear altogether.

1894. Would you tell the Committee how you employ the spirit in making lacquer, and in what sort of quantity you employ it? First, the spirit remains present in the lacquer when it is made, does it not?—In this bottle we have got simply the methylated spirit, and there is no gum added at all; for lacquer making we add gum and the colouring matter—this is for hot lacquer that I am talking about now. When you lacquer a piece of metal, the only permanent result you get in the shape of lacquer is a certain amount of coloured gum which is deposited on the metal. You cannot take the lacquer and put it on dry; you must have some medium. Consequently you have to use spirit to dissolve the lacquer, and then it sticks on the metal and the spirit is evaporated. I think we shall have further evidence to submit to you on that point. In answer to the letter you were kind enough to send me, as to what evidence you would require as to the exposition of the reasons why methylated spirit is held to be injurious to the quality of the lacquer, Mr. Cocking, of Kynoch's, tells me that he thinks the main reason why this objectionable prismatic effect which appears on all methylated spirit lacquers is given to the articles, and is not given to it by a pure spirit lacquer, is that there is a very small percentage of mineralised naphtha added to the commercial wood spirit.

1895. Do you use in your Birmingham factory mineralised methylated spirit?—No, we use what is called the ordinary methylated spirit; but I am told that in that there is a small quantity—I think it is a quarter or a half of one per cent.—of mineralised naphtha added.

1896. (*Dr. Thorpe.*) I may tell you that there is not, and that even in the mineralised naphtha which is on sale in every oil and colourman's shop, the amount is only three-eighths of one per cent.?—Then how do you account for the fact that if you take a wood naphtha lacquer pure and simple, you get none of that prismatic effect which is always followed by the failure of the lacquer, and if you take a pure spirit lacquer you never get any of it; but if you take a lacquer made from methylated spirit you always get it.

1897. Have you tried mixing the wood naphtha which gives you a satisfactory result with the pure spirit which gives you a satisfactory result, and seeing what result there is?—No, and I will tell you why—because this wood naphtha lacquer was only made at Professor Frankland's suggestion on Friday.

1898. You may take it from me that there is nothing in the nature of mineralised naphtha in the ordinary methylated spirit; it does not exist in the wood naphtha, and it does not exist in the spirit, and therefore the putting of them together cannot produce it?—No, of course it cannot if it is not there. It was Mr. Cocking who told me yesterday at the meeting we had in Birmingham of those who were going to give evidence—and he is going to give evidence before you—that possibly that might account for it. He was under the impression that there was a little of this mineralised naphtha in it, that that would prevent a perfect solution of the gum, and therefore that you would get a certain amount of acid formation. Anyhow, he said he would go into the matter and see. I will tell you what I thought would not be an unsatisfactory way of testing it for yourselves. Take those three samples that Mr. Bagley has shown you. One is lacquered with pure spirit, another with methylated spirit, and the third with a wood spirit lacquer. I think it would not be a bad idea if you were to put those in some exposed position about the building—just simply wire them up and see how they stand it.

1899. (*Chairman.*) How long would they have to be wired up before they would begin to show symptoms of change?—I think you would find that the methylated lacquer would show signs of weakness in a very few days. I do not know about the wood naphtha spirit. Of course that is more expensive than the other, and besides that it would not do, because it is very much duller.

1900. What quantity of methylated spirit are you using per week?—We are only just beginning, and we are only just putting it down. There is a huge quantity of it used in Birmingham.

1901. Of course, in varnishing and lacquer work. I understand that you really have not yet got to work in your Birmingham premises?—We have got to work; only, although you may have experimentally done a thing and done it very satisfactorily, when you come to turn it out in large quantities, there are generally some little practical difficulties that are in the way; so we have restricted our trade at present to two firms who both go in for very high-class finish, and they are both of them perfectly satisfied with what we are doing; so now we are putting a lot more down.

1902. When did you actually begin producing?—We only got the official permit on the 4th November of this year. I wanted to make quite sure that we were all right, because, if we were right for those people, we should be right for anybody.

Use of pure spirit lacquer at a high price

1903. Then you cannot speak as regards the alcoholic lacquers from any lengthened experience—in fact, you

Mr. F. Barlow.

30 Nov. 1904.

for special purposes adduced as evidence of its superiority.

are only just beginning to work ?—That is all ; only I know this—that practically every firm in Birmingham that is doing really high-class work is to-day using in very small quantities a pure spirit lacquer upon which duty has been paid. The quantity altogether would be very ridiculously small from a Revenue point of view, but the mere fact that they do pay these prices for that lacquer shows that from their experience it is a better thing. I have got a bit of work outside which was done with a pure spirit lacquer, which shows that you get a whiter effect with it than you could get with a methylated spirit lacquer. If you like to see it, I will show it to you. I got it from Oslers.

1904. While the rod that you have brought up is being fetched, we will go to another point. If you, as a matter of fact, were allowed to use pure spirit, at what point would it be mixed with the shellac ?—We could arrange that a certain quantity of it could be added by the distiller, or we could make it in bond just as they make spirits in bond, and have a proper bonded building.

1905. Is shellac the only thing that you put in ?—That, and the colouring matters.

1906. Therefore, any other ingredient put in for rendering the spirit unpotable would probably not suit your purpose ?—We have not yet found anything that would answer. I have got that piece of work now. You gentlemen are not accustomed to look at lacquers, but any man who is accustomed to look at lacquers would know in a minute that *that* is a specimen of a pure spirit lacquer. You cannot get that whiteness with a methylated spirit lacquer (*exhibiting a lacquered silver rod*).

1907. Has this been specially made as a specimen ?—No, it is just a piece of ordinary work. Oslers only use pure spirit. They do very high-class work and get very high prices, and, as I say, they only use the pure spirit. They would not pay 32s. per gallon for that, if they could get the same effect for 5s. or 6s., at which price they could easily buy the methylated lacquer.

1908. (*Dr. Thorpe.*) This lacquer is put on a white metal ?—That rod is silver-plated.

1909. What it means is that you have got an extremely thin film of something or other, which is sufficiently transparent not to affect the character of the metal ?—That is it. If you had a methylated lacquering on it, it would affect the look of it.

1910. (*Chairman.*) Is this metal silver ?—I do not know that the whole tube is silver ; I should say it is white metal silver-plated.

1911. (*Dr. Thorpe.*) The lacquer is on silver ?—Yes.

1912. (*Chairman.*) A gallon of lacquer would do a great many yards of tubing like that, would it not ?—Yes, it would.

1913. Take, for instance the rods for a bedstead ; the total addition to the cost of the bedstead, resulting from the use of a duty-paid pure spirit rather than of a methylated spirit, would not really be very much over the whole thing ?—No, it would not. But then, on the other hand, in all businesses you will find that you have got to watch your expenditure in every shape and form. Our contention is that a duty-free pure spirit would enable these people to get a good lacquer for less than 5s. a gallon, and then they would be able to get a finish equal to that which is got in the case of this rod. Although the imported lacquers would have to pay duty, there is no duty on the goods that are finished in Germany and in France with a pure spirit lacquer. I know that as far as the lamp people are concerned the competition is very serious, although I do not think people like Heaths' and Evereds' have felt it to any extent.

Safeguards against improper use of spirit if allowed duty-free for making lacquer.

1914. Let us assume for a moment that you are authorised to have brought into your factory pure spirit instead of methylated spirit ; what would you suggest in the way of safeguards against the improper use of that spirit in your factory ?—The factory that we are using at present is an old malthouse with regulation iron bars, iron windows, and all that sort of thing. Therefore, so far as we are personally concerned, there would be no trouble whatever in rendering the thing absolutely secure. The spirit that came in would be checked, and the amount that was sent out would be checked.

1915-6. First of all the spirit would come in, and would be placed in some secure compartment secured by a revenue lock ; then you would want to use the spirit ; what would be your first step towards that ?—We should never take the spirit out of this compartment. We should simply tap it and run it down into the tanks where the shellac was waiting for it.

1917. Then as a matter of fact the spirit would run direct from the containers, drums or casks, as the case might be, in your spirit store, through closed pipes into these tanks ?—Yes.

1918. And in those tanks it would be instantaneously mixed with the gums ?—Yes. You do not expose it any more than you can help, on account of the evaporation.

1919. Would that be true, do you think, of all lacquer works or varnish works ?—One does not know much about other people's works in the same line, but unless they adopt some system of that kind they must lose a good deal from evaporation.

1920. And possible abstraction ?—Yes.

1921. The number of hands that are employed, I suppose, is not very great ?—The number of hands employed in a lacquer works is not very great. We could turn out 4,000 gallons a week of lacquer and not employ more than four men. As a matter of fact, I never let anybody go into the mixing room. Nobody knows what goes into the tanks except myself. It is not much trouble to weigh it and put it in.

Exportation of English lacquer

1922. Of course you cannot speak from your own experience, but does English-made lacquer find a market on the Continent ?—Yes.

1923. I mean, do we export lacquer ?—Yes, we do ; and we did export very much more than we do before the Germans made it.

1924. When it arrived in Germany, was it taxed on the spirit that it contained, or was there a special tax ?—That I do not know.

1925. (*Dr. Thorpe.*) Is it taxed now ?—That I cannot tell you, because personally we have had nothing to do with it. I know that they do not tax our cold lacquer made from fusel oil.

1926. (*Mr. Nicholson.*) There is no tax of any sort on it, is there ?—Not that I know of. When I began to go into this matter I thought that the saving between the cost of the pure spirit and the cost of the methylated spirit would be practically all the difference that we should get, from a monetary point of view.

1927-9. (*Chairman.*) Do you mean between the cost of pure spirit duty-paid or the cost of pure spirit duty-free ?—Pure spirit duty-free.

Relative cost of alcohol and shellac.

1930. As regards the cost of the materials which enter into your lacquer, is the alcohol your main source of expense or are the gums your main source of expense ?—Two years ago I would have said that the alcohol was the chief cost, but not now, when shellac is at its present inflated prices—stuff that was selling at 60s. two years ago is to-day worth 250s. That cannot last very long.

1931. What is that due to ?—A Yankee has taken it into his head that he is going to have it up. He came down three weeks ago to Mincing Lane and put down a credit note for a million and a quarter and said, "Buy T.N.'s. till that is done." Ordinary shellac was about 40s. that morning and went up during the day to 120s. He said he would have Novembers at 250s. and he has got them at that, and he has said that he is going to have Decembers at 300s., but what he is going to do with them when he has got them up to 300s. nobody knows.

1932-6. That is the next step ?—I think he will drop it ; only just at present it is very awkward for lacquer makers. We want all the help we can get in reference to the spirit.

Price of pure spirit and methylated spirit.

1937. (*Dr. Thorpe.*) The real point is what can you get methylated spirit for at 64 or 65 O.P. ?—There is this difficulty to get over, that the methylating must cost more than 3d. per gallon.

1938. We know what it costs substantially to methylate it ?—Of course it makes a lot of difference to me, treating the matter as far as price is concerned.

1939. You buy wood naphtha, do you not ?—We bought some only on Friday, and we only bought a pound, so I cannot tell you what the cost is.

1940. (*Mr. Nicholson.*) It rather affects your calculation, if it is a fact that the difference between pure spirit and methylated spirit is only about the 3d. a gallon you speak of ?—It would if the restriction on the use of the pure spirit were expensive.

Cost of Excise supervision if pure spirit were used for lacquers, probably not less than the saving in cost of spirit.

1941. (*Chairman.*) There would have to be some restriction ?—Undoubtedly there would. I do not know whether Mr. Bagley brought before you the desirability of your seeing a lacquering room ?

1942. I am afraid we could not learn very much from that, because just to go into a lacquering room for once would not be a sufficient amount of experience to enable anyone to form a judgment ?—You would be able to form a better judgment as to whether the workpeople would be likely to drink it.

1943. I do not think we have the least doubt about that. That we settled with Mr. Bagley. It is not the lacquering people who matter; it is the people that make the lacquer who matter. Once the lacquer is made, I think we may feel pretty sure that nobody will drink it, because the fact is that the lacquer is a safer thing even than methylated spirit ?—Yes, because of the gum—because of the shellac.

1944. People would be even less likely to drink lacquer than they would be to drink methylated spirit, would they not ?—I think so. Professor Frankland said that if they did drink it they would know about it, because the shellacs are insoluble in water.

1945. (*Dr. Thorpe.*) Of course it is known that the person who drinks methylated spirit would equally well drink "finish." We know that furniture polishers have been known to drink a solution of shellac in alcohol; so that it is only a question of degree ?—As far as lacquer makers are concerned, they would be quite prepared to make it under any conditions you like, just in the same way that you insist upon distillers making their stuff under satisfactory conditions.

1946. (*Chairman.*) It seems to me that we have got to this point, that as far as the manufacture goes, you probably would not be very much better off with a pure spirit than you are with a methylated spirit—I am now confining myself solely to the cost—for this reason; that while you would get a pure spirit at a somewhat cheaper rate, you certainly would have to pay something fairly substantial for the necessary supervision that the Excise would have to exercise over the spirit ?—Yes.

1947. Therefore I should think that the economy which you would make by using pure spirit instead of methylated spirit, would be almost a negligible quantity; but that still leaves the further consideration which you have urged that the pure spirit makes a very much better lacquer ?—And would lead to an increased trade on that account.

Competition of foreign lacquered goods in home and neutral markets.

1948. As regards the position of the manufacturers of lacquer in this country, from the point of view of equality of conditions with their competitors abroad, you have nothing to complain of in the home market have you ?—No.

1949. Have you anything to complain of in what I may call the neutral market ?—Not that I know of. The only thing that we have to complain about is that this German finished electrical work is coming in in increasing quantities, and the German lamp parts are coming in in increasing quantities, and are being used on account of the superior finish of the pure spirit lacquer; and just for that. The lacquer which comes in on the metal pays no duty.

1950. Have you any reason which would enable you to say that the attraction of these particular goods from Germany is the quality and not the price ?—English lamp makers are now buying parts in Germany on account of the superior finish of their parts.

1951. Do you know that the attraction to them is the superior finish of the lacquering ?—Yes, because they have said to me: "If you can give us a finish like this, then you can make it; if we cannot get any lacquers here that will do it, then we have got to buy these parts.

1952. (*Mr. Nicholson.*) But they can, as a fact, get such lacquer if they choose to pay for it ?—If they choose to pay a big price for it, but then of course when you are doing a very small output of any particular thing it is always very much higher in price. If these people could use this particular shade of colour—this German colour, as they call it—on the whole of their work, that is, if they could use a pure spirit lacquer throughout, of course we could do it very much more cheaply than if we only had to make an odd gallon or so for a man who is doing a special thing. They frequently buy this pure spirit lacquer in quarts. People like Mr. Bagley, who has just been in, use considerably over a hundred gallons a week of lacquer generally.

1953. Of that kind of lacquer ?—No, but of the lacquer that they would take, they would use over 100 gallons in a week, as a steady regular quantity. You can see that it would make an enormous difference in the price if a man were to come in once in a month or once in a quarter and say he wanted half-a-gallon of a particular lacquer.

Alleged use of pure spirit for German lacquers. (*See also* Qs. 1963–6.)

1954. (*Dr. Thorpe.*) You have frequently spoken about the Germans using pure spirit; do you really know that the Germans use a pure spirit for the manufacture of these lacquers ?—I only know that I have had German lacquer and had it analysed, and I was told it was a pure spirit.

1955. Do you mean that there was no denaturant in the spirit ?—There was nothing there but gum.

1956. That was stuff of course which was bought at a very high price ?—No, it was not.

1957. If it came into this country it must, at all events, have paid the duty ?—In this particular case I believe that there was a false declaration on the part of the German who sent it in.

1958. And it slipped through the Customs ?—Yes, it paid no duty. You get just as clear an effect with the fusel-oil lacquer as with the pure spirit; and you do not get the cloudiness that you do with a methylated spirit lacquer.

Fusel-oil suggested as a denaturant in lieu of wood naphtha.

1959. (*Mr. Nicholson.*) Would a fusel-oil lacquer universally answer your purpose ?—Only for certain things. Cold lacquer cannot be applied to a great many things; for them you must have hot lacquer.

1960. (*Dr. Thorpe.*) I do not know whether we could arrive at some method of partially denaturing this material with a view to protecting the revenue, and, to some extent, meeting you on the ground of the cost of the extra supervision that would be entailed. Could you not use fusel-oil instead of wood naphtha as a denaturant ? You have told us that fusel-oil can be used, and that it does not give the cloudy effect; supposing, therefore, you mixed your spirit with fusel-oil and used that instead of the ordinary methylated spirit ?—I will try a sample of that and let you know the result.

1961. You do not know what would be the result now ?—No, I do not; but I will mix it with fusel-oil so as to make it unpotable, and see the effect.

1962. Do you think you could use such a mixture for a hot lacquer ?—I will try it and will let you have a sample. Professor Frankland thought that pyridine would answer better than wood naphtha; the objection to it is that the smell of it is something awful and you cannot imagine anybody living in a room with that stuff on a hot table all day long.

Mr. F. Barlow.
30 Nov. 1904.

1963. (*Chairman.*) I have just turned up the requirements of the German Government as regards the denaturing of spirit for varnishes and polishes of all kinds. They have 2 per cent. of wood spirit with 2 per cent. of petroleum benzin, or as an alternative one half of 1 per cent. of turpentine. That shows that the German lacquer, which is said to be so superior to ours, is not made with pure spirit?—That is in place of our 10 per cent. of wood naphtha; I will try that and see how it answers.

Denaturants used for lacquer-making in Germany. Pure spirit not used in Germany or France.

1964. (*Dr. Thorpe.*) I want this impression, that the Germans use pure spirit for the manufacture of these things, to be corrected. You say that we are at a disadvantage compared with the Germans, because the Germans can use pure spirit and British manufacturers cannot; but you see that is not the fact?—Yes; but I was certainly under the impression that they were allowed to use an absolutely pure spirit.

1965. Neither they nor the French are allowed to use an absolutely pure spirit for this purpose?—I was not aware of that.

1966. May I add that the wood spirit, which is used in German denaturing, is a much more impure wood spirit than we tolerate here, because it contains much more acetones and other impurities than we are in the habit of requiring. I must tell you that large quantities of wood naphtha are sent into Germany from the United States to be distilled for the purpose of taking out the methyl alcohol in it, and the residues, which contain relatively small quantities of methyl alcohol and large quantities of acetones, are used in the process of denaturing; so that it is relatively a more impure wood spirit that is used in Germany than is used here?—I was not aware of that. There is one strong point to be made about the German lacquer and that is this: as an English lacquer maker I am not so much afraid of it, because they are using entirely aniline colours, and our experience shows us that aniline colours do not last.

Impurity of woodnaphtha used for denaturing in Germany.

1967. That depends on the colour; some of them are far more lasting than any vegetable dyes?—They can get very beautiful shades from these aniline colours and they get them very easily; but I was under the impression that these aniline colours did not last.

SEVENTH DAY.

Tuesday, 6th December, 1904.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair*).

Professor Sir WILLIAM CROOKES, F.R.S.
Sir W. H. HOLLAND, M.P.
The Hon. J. SCOTT-MONTAGU, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*).

Mr. EDWARD WILLIAM GRIMWADE, called; and Examined.

Mr. E. W. Grimwade.
6 Dec. 1904

1968. (*Chairman.*) You have been selected by the London Chamber of Commerce, I understand, to give evidence before this Committee?—Yes, so I understand.

1969. You are not, I believe, a manufacturer, but you are a purchaser of chemicals and pharmaceutical preparations?—I am a purchaser and distributor.

1970. Are you a distributor in this country?—No, in Australia and New Zealand.

1971. Only in those Colonies?—Practically; I send very little to the Cape.

Chemical and pharmaceutical products. Distribution to Colonies. High price of certain chemicals in England as compared with Germany attributed to heavy duty on alcohol.

1972. Is the distribution in the Colonies an adjunct of your business, or is it your main business?—That is all my business.

1973. You have given us in your *précis* the following list of chemicals which you state your firm exports:—Gallic Acid, Tannic Acid, Chloral Hydrate, Cocaine, Eserine, Guaiacol, Paraldehyde, Phenazone, Phenacetine, Pilocarpine, Salicylates (Acid and Soda), Santonine, Sulphonal, Thymol, Aconitine, Antipyrine (Lion), Atropine and Salts, Butyric Ether, Cantharidine, Heliotropine, Vanillin, Capsicine, Gingerine, Resin Scammony and Male Fern Oil?—That is so.

1974. I understand that the value of your exports in these articles is about £2,600?—Yes, that is about the average; that is within the year.

1975. Is there any one of the chemicals in your list that is manufactured in this country?—Yes, I should think some of them are; but they are not manufactured at such a price that we can ever buy them of the English manufacturer; and I have given you in my *précis* the reason why I believe the price is affected, namely, the heavy duty paid on spirits of wine in England

1976. Do you as a matter of fact know much about the price at which these chemicals are sold in this country; take, for instance, antipyrine?—No, I do not know anything about that; and I could not tell you off-hand what I pay, as I did not know I should be asked that. Of course I know the price at which I could buy it from abroad. We do not sell anything here except eucalyptus oil, which is imported from the Colonies.

1977. (*Dr. Thorpe.*) You mean that you do not purchase any here, do you not?—I purchase all here, but I do not sell anything here except eucalyptus oil.

1978. (*Chairman.*) When you say that you purchase here, what do you mean?—I make my purchases here, either by letter or through agents of the foreign manufacturers of the different lines in which I get orders.

1979. Are any of the articles mentioned in your list subject to duty here?—Yes; chloral hydrate is.

1980. And butyric ether also, is it not?—Yes, ether, of course, would be subject to a duty; but I do not know why on earth that is put down, because the quantity that I buy of that is absolutely nothing.

1981. The total amount of these purchases does not seem to be very large?—You must recollect that is only one house.

1982. Is your house one of many in this particular branch of the trade?—Yes.

1983. What proportion of the total amount of trade in these particular chemicals do you suppose that you do?—That is an almost impossible question for me to answer. I buy really for eight or nine of the chief wholesale druggists in New Zealand and the Colonies, and that is all my business. If you take into consideration that the London druggists have all the world practically at their feet, you will see that it is somewhat difficult for me to estimate what proportion our little purchases are compared with theirs.

1984. May we presume that all the business that is done of the kind that you do is done in articles brought from abroad, and that none of them are manufactured in this country?—No, there are a large number of lines which I do buy which are manufactured in England. These are special lines which have been picked out, which I cannot buy in England on account of the price.

1985. In other words, these articles that you name here do not by any means represent the whole of your trade?—No.

1986. (*Dr. Thorpe.*) You do not wish to imply that these chemicals are not made here, do you?—I do not wish to imply that they are not made here, but I do wish to imply that I have never been able to buy them here on account of my being able to buy them cheaper in Germany.

1987. (*Chairman.*) Have you from time to time tested the markets in this country?—Yes, continually for the last, unhappily, forty years.

1988. Supposing a manufacturer in this country of any one of these articles proposed to himself to export to Australia and New Zealand in competition with you, would he have no chance of coming down to your price?—None whatever; or he would get the supplies from the same source practically that I do. You are having evidence from one or two of the wholesale trade in London, I think, including Mr. Webb, who has one of the largest businesses that we have in our trade, and he will tell you that he has to get his supply of these particular chemicals practically as we do ours. These are only the lines I have picked out, you will understand, that we are compelled for the reasons I have given to buy abroad.

1989. How comes it that there are English makers of some of these articles, if there is such a vast difference in the price? The English makers must find a market somewhere. How do they manage to keep even the home market?—I do not think the English makers make these, for the reasons which I have given—at any rate, it is not within my knowledge that they do.

1990. (*Dr. Thorpe.*) Are you speaking now of antipyrine alone, or are you speaking of all the articles on this list?—I am speaking of the articles on this list.

It is not denied that such preparations are made in England.

1991. What I want to get from you, and what I think we all want to get from you, is—Do you say there are no persons in England making these articles?—No, I am not going to give such a big order as that. I am only speaking of my own knowledge, recollect; and I cannot state a fact as broad as that. Take, for instance, resin scammony—I think that that possibly may be made here, but not always.

1992. (*Chairman.*) Take cocaine?—That is made abroad.

1993. Do you suppose there is no manufacture of cocaine in this country?—I do not know of any. I am only speaking of my own knowledge, please.

1994. (*Dr. Thorpe.*) I am prepared to put in a list of English makers of practically every one of these chemicals, and in some cases there are half-a-dozen makers?—I should not dispute that at all; indeed, I should be quite willing to admit that. I only say that if they do make them, they cannot make them at the price the Germans can, or at all events they do not sell them at the price the Germans do.

1995. (*Chairman.*) Then you really have no very intimate knowledge of the subject?—No. As I have said, I am merely a distributor; I have to buy these things in the cheapest market that I can, and they are shipped abroad, and they are none of them sold here.

1996. You yourself attribute that, without being absolutely certain of the fact, to the greater expense of alcohol in this country?—That is the reason that has always been given to me.

Mr. E. W. Grimwade.

6 Dec. 1904.

1997. But you have not investigated that reason for yourself?—No, I only know that spirit is free in Germany, practically, and that here a duty has to be paid. I buy a great deal of spirits of wine from Germany which is shipped from Hamburg as a rule.

1998. (*Sir W. H. Holland.*) May we take it that the views you have expressed are not merely your own views, but that you are here in a representative capacity to speak on behalf of many others in the same trade?—I do not to my knowledge know that I appear as representing anybody.

1999. You have not been appointed, then, as a representative?—I was asked by the London Chamber of Commerce as a fairly large distributor of drugs and chemicals abroad, if I would give evidence. That is all.

2000. So these are only your individual views?—Yes

2001. I thought you might perhaps have been in consultation with some others in the same trade?—No. I think Mr. Murray of the Chamber of Commerce wrote to say that my name had been given to them, and to know if I would give evidence simply as a distributor. I have no technical knowledge of manufactures at all.

2002. (*Dr. Thorpe.*) Do you intend, in putting this list in, to convey the impression that these are things which cannot be made and are not made here?—No, I do not put that list in for that purpose. I am willing to admit, as you say, that they are made here. All I say is that I cannot buy them as cheaply here as I can from Germany and elsewhere on the Continent. The reason why, so I am informed, but I have no practical knowledge, is on account of the increased cost of manufacture here.

2003. (*Chairman.*) Could you in respect of any one of these articles tell us what the difference in price would be at this present moment between a German-made article and a British-made article?—I really could not tell you that off-hand.

Chloral Hydrate.

2004. (*Dr. Thorpe.*) Take, for example, the case of chloral hydrate. How much chloral hydrate is imported here compared with what is actually sold and distributed here?—I could not tell you.

2005. (*Mr. Tyrer.*) There is no chloral hydrate manufactured in this country, is there?—I never heard of any.

2006. I believe I am perfectly right in saying that English wholesale drug exporters will order foreign firms to consign to their order in India, Australia, or elsewhere?—Yes.

"Convention" prices in Germany.

2007. So they have the business in a way, but do not handle the goods; they simply get their commission and have done with it?—Yes. A great many of the lines that I have mentioned here, where the quantities have been big enough for shipment abroad direct, unfortunately instead of coming to this country and being handled here by being passed from steamer to the docks, and all that sort of thing, and out again, are shipped direct from Hamburg. Every steamer that leaves Hamburg I have shipments in practically. There is one point that I think I have noticed—I do not know whether it is of any value to you. A great many of the lines that we have to buy in Germany are sold at what are called "convention" prices, that is, the makers all enter into an arrangement that their price for a certain article shall be 1s. per pound, say, and then they all charge 1s. per pound. That gives them a very great advantage. They are able to do that, for the simple reason that the manufacture of these lines cannot be carried on in this country on account of the increased cost; therefore they are able to take advantage of that and to make their conventions as to prices.

Dr. WILLIAM REGINALD ORMANDY, recalled; and further Examined.

2008. (*Chairman.*) Your evidence to-day, I understand, is to be confined to the use of alcohol as a motor fuel?—Yes.

Alcohol for motors. Necessity for complete denaturing.

2009. Here we come to a branch of the subject which differs very much from any that we have taken up before in this respect, that alcohol as a motor fuel clearly cannot be subject to supervision in the same way as alcohol used in the factory can?—That is so.

Dr. W. R. Ormandy.

6 Dec. 1904

2010. I suppose we should all be agreed that any idea of using alcohol in at all a pure state for motors is quite out of the question?—Quite.

2011. Further, I suppose we may assume that it must

Dr. W. R. Ormandy.

6 Dec. 1904.

be very completely denatured if it is to be used as a motor fuel ?—Naturally, because it is getting into the hands of the public widecast.

Suitability of Methylated Spirit as regards character. (*See also* Qs. 2027-42.)

2012. Now let us take the complete denaturing that we have at present in the form of ordinary methylated spirit. Are there objections to the use of that ?—There are some objections which I propose to deal with under a special heading in my proof—"Heading 4. The influence of denaturants on alcohol used as a motor fuel." Knowing the subject was so entirely new, I started out in getting the *précis* together on the understanding, first of all, that it was necessary to prove that alcohol was a suitable fuel, it not having been used in this country at all, and that practical results had been obtained with it in other countries ; then that I must prove further that not only was it suitable, but that it had many theoretical advantages, which advantages I wished to bring before your notice. Then I proposed to discuss the question of the denaturants ; and then the general possibilities.

2013. I was rather starting to work backwards, and I am not at all sure that working backwards is not the best plan in this particular instance, because it will define the possible area of use better if we arrive at a conclusion with regard to the amount of denaturing that is required ?—Yes, possibly it will. I should like to state here that the present denaturants would not by any means render alcohol impossible for use for motor purposes. I should say that if the large amount of impure methyl alcohol—for it contains, I believe, a considerable quantity of acetone, does it not ?

Absence of acetone desirable

2014. (*Dr. Thorpe.*) As a maximum, 12 grammes per 100 ?—If then this impure methyl alcohol containing so large a percentage of acetone could be replaced by something more acetone-free, it would be an advance from the motorists' point of view, but I should not like to say that it would prohibit its use at all.

and a constant proportion of water.

2015. (*Chairman.*) Could the present methylated spirit be used exactly as it is, without any admixture of other elements in it ?—It would be advisable in using ordinary methylated spirits to have a regulated and known quantity of water present. I do not know whether that is the case now, but the percentage of water should be fairly constant and should be known ; it should approximate to 10 per cent.

Benzol as substitute for part of the wood naphtha now used.

2016. (*Dr. Thorpe.*) Whatever it is it is known, and it is constant ?—Then that could be easily regulated. The addition of a small amount of benzol (C_6H_6) would be of advantage from the motorist's point of view, and also from the point of view that it would aid, I take it, in the denaturing, if you were to add 2 to 5 per cent. of ordinary crude benzol.

2017. (*Chairman.*) You would start with your present methylated spirit, and then you would make a special compound for the spirit to be used for motors ?—Yes.

2018. Would there be any objection to starting with a methylated spirit exactly as it is now, or would you want to substitute the benzol for some portion, say, of the wood naphtha that we now put in ?—As I said before, if that would be allowable—if that would be considered a sufficient guarantee—it would be preferable to replace a portion of the crude methyl alcohol by something else.

Possibility of removing benzol, and with it some of the nauseous ingredients of the wood naphtha. (*See also* Qs. 2142-56.)

2019. Now take benzol ; is that not very easily removed ?—I am afraid it is rather easily removed up to certain limits. In order to ascertain what those limits are there is a good deal of work, I believe, being done now, and I have asked Dr. Thorpe if he would let me have some information with regard to that, as I am working on that very subject at the present time. By the addition of water it is possible to separate the benzol from the alcohol to a very considerable extent. How completely that can be done by each particular addition of water I cannot say ; but you may dilute the alcohol very considerably, and that will still leave the methyl alcohol and the pyridine bases in.

2020. (*Dr. Thorpe.*) Would you use the pyridine bases ?—I do not know whether they would be removed completely by the amount of dilution that would be necessary to remove the greater portion of the benzol. Those are points which have been worked out most thoroughly in your laboratory and which I knew you would know, and therefore I have not worked on.

2021. Of course if you have in your denatured motor-alcohol the hydro-carbon, benzene, and you add water to it, the benzene separates, but it is not pure benzene that separates, is it ?—No. You get an ordinary mass reaction ; you get them dividing up according to the phase law and according to their relative solubilities.

2022. Is what happens that what you call the impurities in the wood naphtha are dissolved ?—I should say that a certain portion of the pyridine bases would certainly dissolve in the benzol.

2023. In that way, therefore, the benzol has acted as a purifying agent to the methylated spirit ?—Yes, to a certain extent. It is a question how much is diluted and how much benzol remains in place of the amount of pyridine which the benzol which has separated has taken out with it.

2024. That is true ?—From my own experiments I find that it is an exceedingly complicated question. The number of possible mixtures and complications is so enormous that it is an exceedingly difficult thing to work out.

2025. Have you noticed in the case of the motor-alcohol with benzol in it, when you have diluted it with water and you have separated by the addition of water the benzol from it, that the benzol, as it rises to the surface, carries with it a certain quantity of the empyreumatic matter and the pyridine bases—the substances, in fact, which give wood naphtha its particular value as a denaturant—and that therefore the benzol takes those things out ?—It certainly takes a certain proportion of them out.

2026. And leaves, therefore, an aqueous alcohol which is potable ?—It may be potable to some people, but are you going to wait till you can make an alcohol which nobody will drink ?

Methylated Spirit. Its unsuitability for motors not proved, but suspected, as giving rise to acetic acid.

2027. (*Chairman.*) Do you consider that in the present methylated spirit taken by itself, there are elements that are seriously prejudicial to its use for motor purposes ?—How seriously prejudicial one cannot say, because so little work has been done with motors running with alcohol of the composition used in methylated spirits in this country. What is known is this—that the greater the percentage of acetone present in the alcohol that is used, the greater the percentage of acetic acid which is formed in the by-products resulting from the explosive mixture, and consequently the greater the wear and tear on the valves and the moving parts in the cylinder. But it is not only the acetone which is present. It has been proved that methyl alcohol in the presence of air at such temperatures as 250° Centigrade forms acetone or by-products such as formaldehyde and other substances, which readily give rise to acetic acid on their combustion or on their partial combustion. This temperature of 250° Centigrade is one which is attained by the actual mechanical compression of the gases in a motor built to work with alcohol, since ten atmospheres to fifteen atmospheres are common compressions. By compressing a gas containing methyl alcohol to ten or fifteen atmospheres its temperature is raised without explosion to more than 250° Centigrade, and at that temperature methyl alcohol readily splits into compounds which on ignition with air tend to form acetic acid. The presence even of methyl alcohol without acetone is more or less of a drawback—how far it is a drawback it is impossible to say without rather prolonged trials, since in Germany, where the longest trials have been made, there is only 1¼ per cent. of the general denaturing agent present in the motor spirit.

2028. (*Mr. Scott-Montagu.*) You have spoken of 250 degrees Centigrade ; what is that equal to, Fahrenheit ?—That is roughly equal to 480 degrees Fahrenheit.

2029. The temperature of petrol explosion is more like 1,200 degrees Fahrenheit, is it not ?—I am not speaking of the temperature of explosion. I am referring to the temperature which is attained at the moment of full compression before the spark passes ; it is the heat given out by the sudden compression.

2030. (*Dr. Thorpe.*) Your point is that the sudden compression bringing about this heat, resolves methyl and methyl compounds into substances which eventually are oxidised to acetic acid ?—Which tend to give acetic acid.

2031. What is the proof of that ?—Longridge quotes good deal of the work which has been done by Sorel.

The papers by Captain Longridge are published in the *Engineer* of June 5, July 24, August 7, and August 28 of 1903. Those papers contain a *précis* of the papers by French authors dealing with the peculiar decomposition which takes place in methyl alcohol when mixed with air when heated to low temperatures—I mean comparatively low compared with the temperature of ignition—in contact with metallic surfaces. To my mind most remarkable results were obtained, the alcohol being split up into aldehydes and the like at temperatures far below those at which one would naturally incline to think that chemical action would start.

2032. This is perhaps rather technical and rather intricate, but, of course, what is implied by all that is this, is it not, that the reactions under which formaldehyde is made from methyl alcohol go on in contact with metallic surfaces at the heat of compression—that is what you really mean?—Yes, that is what I wish to say. But whether that chemical action is sufficiently intense to cause enough acetic acid to damage the moving parts of a motor, there is not yet sufficient evidence gathered to show.

2033. Of course it is a question what would become of the acetic acid in the actual explosion. These are the intermediate products formed as the result of compression, before the actual ignition takes place, and therefore before the actual explosive combination takes place?—Yes.

2034. But what happens then?—It is found that the exhaust products from engines running with a large percentage of methyl alcohol and acetone, contained appreciable percentages of acetic acid in the waste gases, whereas the by-products from explosions taking place without an admixture of those things is much freer from acetic acid.

2035. Have any experiments of this order been made with pure ethyl alcohol? The acetic acid which you have mentioned is not a normal derivative of methyl alcohol. What you are leading up to, I take it, is that you must, if possible, get rid of the acetone which is a dimethyl ketone and all the other acetones; and you also think that it would be an advantage even that the methyl alcohol should be got rid of. That is what you are labouring to prove, is it not?—Yes.

2036. Because it gives rise to acid products?—Yes.

2037. You quote some experiments which have been made upon denatured alcohol, and you refer those acid products which are found to exist in the exhaust gases to the methyl alcohol?—Yes.

2038. I want to know what is the proof that those acid products actually did come from the methyl alcohol, and I ask in that connection, have similar experiments been made with pure ethyl alcohol?—I could not say, except that the German motor-spirit contains very little methyl alcohol, and the exhaust gases contain little or no acid products.

2039. (*Mr. Scott-Montagu.*) What is approximately the temperature of explosion; is it 1,200 degrees Fahrenheit?—The temperature of explosion is much higher than that, it is nearer 1,200 degrees Centigrade.

2040. Whatever it is, taking it to be 1,200 degrees Centigrade, do you not think that a great many of these deleterious substances might be split up and carried away?—It depends on a lot of things. It depends on the temperature of the cylinder surrounding walls. It depends whether your carburetter is giving you the full amount of air, or whether you are working with a minimum quantity of air, or an excessive quantity; it depends also, upon whether the piston is travelling nearly as fast as the explosion, or whether you are throttling down and working under a small compression or under a big compression. So many things pay a *rôle* in it that it is impossible to answer a question of that sort with a simple yes or no.

2041. (*Chairman.*) I rather understood you were not prepared to say that the present methylated spirit is not unsuitable, but you have considerable suspicions of it; is that so?—That is true; that puts the situation clearly.

2042. You say those suspicions require confirmation?—That is so.

Question of an alternative denaturant for motor spirit.

2043. Therefore the first desideratum is not reached, namely, proof that the ordinary methylated spirit is unsuitable; but if we had got to that point, could you then suggest any other way in which the revenue could be protected?—I could only, in reply to that, point to the methods which have been adopted elsewhere. I have gathered the impression, however, that those methods are not considered sufficiently complete in this country.

The French denaturant.

2044. (*Mr. Tyrer.*) What is the general denaturant used in France?—They use in France a mixture of 10 per cent. of wood naphtha, and I believe a minimum quantity of benzol is used at the same time—not, possibly, of necessity to satisfy the Government requirements, but because the alcohol has to be made suitable to the existing petrol engines, and a mixture with 10 to 50 per cent. of benzol works better in the existing engines than the alcohol without the benzol.

The German denaturant.

2045. I did not quite understand what the $1\frac{1}{4}$ per cent. was in regard to Germany?—The ordinary denaturant in Germany is $2\frac{1}{2}$ per cent. of a mixture which, when I was in Germany, consisted of three volumes of impure methyl alcohol and one of pyridine bases. I have not received a word from Germany as to whether any alteration has been made yet, although I am expecting it every day; but from what Dr. Thorpe has told me the ordinary denaturant is now $2\frac{1}{2}$ volumes per cent. of a mixture consisting of four parts of impure methyl alcohol and one of pyridine bases. For motor purposes, however, they are allowed to use half this quantity, that is $1\frac{1}{4}$ volumes per cent. of the general denaturant, together with not less than two per cent. of benzol and sufficient methyl violet to make the material violet-coloured.

2046. (*Chairman.*) Do you know at all how far that has been found satisfactory in Germany?—As to the result, do you mean, attained by its use in engines for motor cars?

Its satisfactory results.

2047. (*Dr. Thorpe.*) It is used very largely there for agricultural machinery, but not so much for motor cars; is that not so?—I believe there are a large number of gas engines there of a similar type exactly to the engine used on a motor car, except that they are larger and slower moving. They are working with this substance with every degree of success; and there is no question as to their absolute success, nor is there any question as to the eating away of the valves or anything by acetic acid in these engines. The percentage of methyl alcohol which has been used is, of course, very small, being only at the outside $1\frac{1}{4}$ per cent. of a mixture containing four-fifths of its volume of methyl alcohol. Therefore the fact that this mixture has worked successfully would not be very strong evidence as to what might happen with a very much larger percentage.

2048. (*Chairman.*) Could the methyl violet dye solution be easily removed?—When you have a mixture of benzol and this coloured alcohol, the whole mass becomes coloured; then if you add water to the mixture, the dye remains dissolved in the alcohol, whereas the benzol comes to the surface. Whether the dye could be removed by filtration through animal charcoal I do not know.

2049. (*Mr. Tyrer.*) It could not?—That I could not say.

Reason for addition of colouring matter.

2050. (*Chairman.*) Then, in point of fact, the dyeing of the spirit affords very considerable security?—Yes, unless distillation takes place.

2051. (*Dr. Thorpe.*) I think you know why the dye is added, and perhaps you will tell the Committee exactly. It is not really for the sake of additional security at all, is it?—I should not like to say it was not for the sake of additional security, as that may be quite distinctly an item; but it is also, first, added as a safeguard against this spirit being bought and, in spite of its disagreeable ingredients, used for admixture with drinking alcohol; and, secondly, it is added because it is sold at a lower price than the industrial alcohol which is used for lamps. It is not suitable for use in lamps, owing to the hydrocarbons, the benzol, which it contains. It is to protect the people themselves in using industrial alcohol for lamp purposes from being served with this material (which is sold to the retailer more cheaply) in the place of the material which they are paying for and should have.

Dr. W. R. Ormandy.

6 Dec. 1904.

2052. That, if I may venture to say so, is the real cause of the addition, namely, to prevent the substitution by shopkeepers and traders of a thing which, under the spirit arrangements in Germany is deliberately and avowedly being sold at a lower price for machine purposes than the alcohol which is used as fuel for lighting and heating; it is to protect the poorer people from being supplied with this cheaper oil that it is coloured?—Yes.

2053. (*Chairman.*) Still, if it affords protection to the purchaser it might also afford protection to the revenue if it could not be easily removed?—It is easily removed by distillation, I suppose, but I know that Dr. Wittelshöfer does regard it personally as a considerable protection; he told me so himself.

2054. (*Dr. Thorpe.*) Anything which gives people trouble to do, of course is *pro tanto* a protection?—Yes.

Limited use of alcohol for motors in Germany. The reasons.

2055. (*Chairman.*) As a matter of fact the use of alcohol in motors in Germany, in spite of the advantages which are given, is not very extensive yet, is it?—That is true; but it seems to me that the reason lies very much on the surface. The agencies for the distribution of motor alcohol are by no means so complete as are the distributing facilities for petrol, since petrol is distributed through all the agencies which are instrumental in distributing ordinary paraffin oil, or can be, since they are largely controlled by the same people. In the second place, it would not pay the big motor manufacturing firms to start making engines and put down plant and make templates for machines, specially designed to run with alcohol, which would only be sold in Germany, say, where the alcohol is comparatively easily obtainable, and which would be useless outside the boundary of their own country. The German manufacturers, I mean the Mercedes people, probably send more cars to this country than they sell in their own. These cars would be useless here, because if built to work to the best advantage with the aid of alcohol they would work at such a high compression that they could not be used with petrol at all. The use of alcohol must become pretty equal in various countries, because these big manufacturers, who look to a European sale, and not merely to one in their own country, will not go to the expense of building motors for use in one country only.

General question of suitability of alcohol for motors. Some objections controverted.

2056. Still I rather gather from an Article in *The Motor* of February 15th, 1904, that there is a considerable difference of opinion as to the suitability of alcohol as compared with benzene. I will just ask you whether you would agree with one or two of the remarks that are made in that article. It says that with alcohol the temperature of vaporisation is too high for a practical motor, and that it would not fire until the engine got warm; is there any truth in that?—From my point of view, I look upon the fact that it has a high temperature of vaporisation as a distinct advantage, because it means to a large extent that its vapour pressure is lower, and that the temperature of ignition will probably be higher; consequently it is a substance which is less dangerous from a fire point of view. As to the second statement, that the motor must be warm to start with alcohol, that, as I have proved by experiments, the results of which I only got to-day, is not a fact. I have designed, and have now running an alcohol engine or a petrol engine, or a high speed engine I should say, with a special carburetter, made by the Belsize Motor Company, which has on a number of occasions started absolutely cold with alcohol and with commercial methylated spirits which have been diluted down to contain 10 per cent. of water, and which have had added only 5 per cent. of benzol. That is a positive proof that that statement is not reliable.

2057. The article goes on to say that the warmth has to be brought about by the initial use of benzene, and hence complex apparatus is necessary. Do you know of any cars which have been made with special apparatus in order to get over that difficulty?—The complication is a myth. It is simply necessary that the motor shall have a double carburetter. The expense of a double carburetter is a mere nothing—a £5 note on a £500 car would probably be the difference in cost of having two carburetters. Then you would have a two-way switch, or a two-way pipe. You would simply turn one on and start your motor, and then in a moment or two you would turn the other fuel into the carburetter. There is, in fact, in Germany a motor arranged which automatically starts with petrol, and then when the engine gets going with a certain velocity it automatically cuts the petrol off, and turns the alcohol on. Given a suitable carburetter, I think it is within the bounds of possibility to start cold with alcohol, and to remove whatever disadvantage there may be in having to carry two carburetters.

2058. The fact you mention seems to me to show that even in Germany, where they have every advantage as regards the use of alcohol, the question is still regarded as being in an experimental stage?—I do not think that that conclusion can fairly be drawn. It is not in an experimental stage as regards industrial motors, but merely as regards vehicles intended for pleasure purposes. The Government vehicles—the Post Office vans, a good many of the War Office vehicles, in fact many of the vehicles used in various branches of the national service are running with alcohol motors in Germany.

2059. I was referring rather to the fact that they thought it necessary to make a car with a double carburetter, so as to begin with petrol and go on with alcohol?—It is true that that has been done up to now and with the carburetters which exist, which have been primarily designed for petrol, and have simply been slightly modified to work with alcohol, it has been found that a double carburetter, if not a necessity, has saved so much trouble that it has been worth the small additional cost in construction. But given things designed for the purpose, I do not suppose it would be a necessity even.

2060. I will just mention one or two of the other objections given in the article. The next is that the susceptibility of alcohol to moisture in the atmosphere would make it difficult to get an explosion in rainy or foggy weather. Do you attach any importance to that?—Not at all.

2061. The next is that alcohol is not so pure as benzene, and is thus liable to choke the spraying tubes?—I think that last statement is almost sufficient in itself to prove that the man who wrote it knew so little about the subject that the remainder of the article is not of value.

2062. It comes from the German *Technische Rundschau*?—It has been probably abstracted by somebody who has been very ignorant of the subject, and certainly bears sufficient evidence of itself that the man is ignorant of the elements of ordinary scientific knowledge with regard to the impurities in alcohol.

2063. (*Dr. Thorpe.*) It is quite possible that alcohol might be muddy and turbid?—Quite so, and so might petrol.

2064. (*Chairman.*) Then it says that an engine which has been driven for some time by alcohol, and then allowed to get cold could not easily be re-started, often not till the plug had been taken out and cleaned of the deposits precipitated by the current?—Those are really things that one would find it difficult to answer.

2065. (*Dr. Thorpe.*) That is evidently written by a man who is not a friend to alcohol?—It is written also by a man who is not aware of the scientific phraseology with which it is necessary to explain a matter, if he is to be clear and and accurate.

2066. (*Chairman.*) Then we need not perhaps go on, but as it appeared in a German paper, and was quoted in a recent number of *The Motor*, I thought it was worth while putting it to you?—I get all cuttings relating to this matter sent to me, and this is put in my cuttings book with a cross on it, which means that it is not worth answering.

2067. I am sorry I troubled you with it then.—In the evidence that I propose to give under heading 3, I should answer many of the questions which are brought up by this article.

2068. Heading 3 would be exceedingly interesting, but as far as the Committee is concerned it is really enough for our purpose to know that alcohol could be used with advantage under certain circumstances. What its relative advantages may be as compared with petrol or benzene really concerns motorists rather than us. If we are satisfied that under certain circumstances of price, or for other reasons, alcohol would be a desirable motor fuel, that would be enough for us, and would enable us to go on to the consideration of the question, what conditions might be attached to its use?—I was not, of course, aware what amount of proof you would consider necessary as to the fact that alcohol was a suitable fuel for motors.

2069. I do not think there is really very much doubt about that, is there ?—As a matter of fact, I think motor manufacturers themselves are quite as ignorant as the general public as regards the possibilities and the advantages of alcohol as a motor fuel. There is one point of the subject which has not been touched upon, and that is one that is referred to in Part 2, Heading 1 of my *precis*, as to the present position in England with regard to the source of our supply of fuel for motor cars, submarines and internal-combustion engines other than those working with gas. That is probably a point of the very greatest importance, and a point upon which the greatest weight ought to be laid, as showing the necessity for so arranging matters that it will pay the motor manufacturer at the present time to begin experimenting with alcohol-driven motors.

Motor fuel. Question of supply.

2070. You say in your *précis* that the motor fuel is at present in few hands, and that these are chiefly foreign. Take petrol; where do the supplies of petrol come from at the present time ?—It is very difficult, I may remark, to get any accurate information with regard to the situation, as there are so many cross-currents among the present paraffin people. But the position, as near as I can make out from information I have got from Germany and from various people in England, is as follows: There is the Rockefeller interest in America, controlling the whole of the American output, and there is the Nobel interest in Russia controlling the whole of the Caucasian and Aspheron output. The Nobel companies are largely financed by Rothschild who is financing, probably, the greater number of the Baku companies. Rothschild and Nobel work absolutely in harmony, and they have a working arrangement with Rockefeller, dividing the world between them as a market. Marcus Samuel, of London, first of all acted as distributing agent through the means of the Shell Transport and Trading Company for Nobels; then he left them and acted as distributing agent for Rockefellers.

The petrol market controlled by two or three combinations

2071. Those two sources of supply do not exhaust all the sources of supply, do they ?—Those are the two principal ones. Then Samuel got his hand to a large extent on the Hollandish-Asiatic field, that is the Sumatra field.

2072. (*Dr. Thorpe.*) What you are driving at is this, is it not; you want to inform the Committee that practically the whole of the future of the motor industry, as regards this particular type of fuel is in the hands of two large trusts or three large trusts, and to that extent the development of the industry is handicapped, and therefore there ought to be a reasonable outlet for the introduction of a suitable fuel, which you think is alcohol. That is your point, is it not ?—I think that is the conclusion which one can naturally draw from the position of affairs as described.

2073. I think we are all aware of that ?—How far you are aware of the exact position at present of the petroleum industry, I do not know; but it took me a very considerable amount of writing altogether, backwards and forwards, to get anything like a consistent statement with regard to the present position.

2074. But the general fact is known to us; I mean to say, that Rockefellers and Nobels and their associates have control of a very large section of the petroleum trade, not only for motor purposes but for illuminating purposes, for machinery oil, and everything of that kind ?—That is known, of course, to every one; that is common knowledge.

2075. Therefore, inasmuch as petrol is a subsidiary product of the operations of these people, of course they also control petrol ?—In so far as it comes from one or two sources; but that does not explain in any way what is the position with regard to the very large quantities that are coming from two or three outside sources. The public might conclude that these outside sources were in opposition, and were likely always to remain in opposition to these people, and that in consequence of that opposition the public would always be able to play one off against the other, and still to get their supply of petrol at a reasonable price. That these so-called outside sources of supply are in danger of getting into the hands of one or two people who may eventually, and probably will, sooner or later, amalgamate with what are at present conflicting interests, was a thing which I was myself perfectly unaware of until a comparatively short time ago. People in the motor industry themselves will tell you that our safeguard lies in the fact that Roumania can send us what we want—that we can get it from the Dutch-Roumanian field, or we can get it from the Roumanian field proper, or we can get it from Sumatra. They are not aware that there is a third combine controlling the whole of those interests, which at any moment may throw in its lot with whichever of the two big combines makes them the finest offer. That is the position at the present time.

2076. (*Chairman.*) But the result at the present moment is that petrol is very cheap ?—At the present moment it is sold actually in Manchester at a less price than twelve months ago they would make a contract for a million gallons f.o.b. at Liverpool. I can buy forty gallons of petrol to-day at Manchester at a less price than I could have got a contract for 10,000 gallons f.o.b. at Liverpool twelve months ago.

2077. (*Mr. Scott-Montagu.*) May I ask at what price ?—Below 6d. per gallon delivered in 40-gallon steel drums at Manchester.

2078. (*Dr. Thorpe.*) What is the inference from that ? —The inference from that is that at any moment there may be a combine of all the present conflicting interests, and that they can then put petrol up to any price.

Possibility of a rise in price of petrol.

2079. (*Mr. Scott-Montagu.*) As they have done in the last five years ?—Yes. They will put it up to the highest price possible.

2080. (*Chairman.*) Does it not point to this, that the sources of supply are so enormous that you cannot do more than keep up the price by combination to a certain amount without ruining yourself ? After all, petrol is not an absolute necessity, and they cannot put up the price beyond a certain amount. You might as well say that the Rothschilds and the Rockefellers could buy up all the corn in the world ?—The position with regard to petrol is somewhat different. In the past the very volatile elements of paraffin oil were removed by blowing, or were allowed to escape in the first operation of the distillation, as it was not worth while going to the expense of putting up the big condensers which are necessary in order to recover them. Even now, many of the American works which are isolated prefer to blow them off and to get rid of them by losing them in the air, rather than to put up the necessary plant which would not pay for the possibly small yield. But it would pay those big combines to do it. I may take a parallel from the case of the United Alkali Company. It pays them to run two or three of their works and make them pay well, and to shut up a large number of the others. It may pay, and it would pay, to sell just sufficient petrol at a large price, the chief expense being in the handling of it and not in the getting of it, and to let the other go—that is, to go on to the old and cheap method of refining the oil and letting the volatile portion go.

2081. That is all a question of price; and after all, although you are more or less at the mercy of three great combinations at the present time— ?—Two, you may say.

2082. Yet their tender mercies are such that you can get petrol at 6d. per gallon ?—Owing to a conflict between them at present.

Present price of petrol.

2083. (*Mr. Scott-Montagu.*) Just lately ?—Only within the last two or three months.

2084. (*Chairman.*) Compared with the lowest price at which you can conceivably get alcohol, it leaves you such an enormous margin, that it is almost wasting time to discuss your protection in getting the quantity that you require ?—The lowest price of petrol at which it pays competing firms to distribute it is 10d. to 1s. per gallon; so that it is undoubtedly true that they are selling it now at an absolute loss.

2085. (*Mr. Scott-Montagu.*) If you went out here into the Waterloo Bridge Road and bought any, you could not get it under 1s. could you ?—No.

2086. (*Mr. Tyrer.*) And it is a fact that at the price at which they are selling it, it is sold at a loss ?—Yes.

2087. (*Chairman.*) Then the present price is an abnormal price ?—It is. That is probably due to the efforts which have been made chiefly by Rockefeller, to throw Samuel and the Asiatic Petrol Company out of the market.

Dr. W. R. Ormandy.

6 Dec. 1904.

Importance of the alcohol question to the motor industry, in view of present conditions of the petrol market.

2088. (*Sir W. H. Holland.*) But it merely relates to this market, does it not; because in the Russian market, prices are rather high?—That may be. The Russian supply is not very important from the petrol point of view, as there is a low percentage of the volatile hydrocarbons in it. So long as the Committee realise that the present automobile industry depends entirely upon the supply of a certain fuel, and that if the supply of that fuel were to be cut off by combination, or if its price were to be raised excessively, or if it were to be stopped through war—of course, in the case of war it would be one of the earliest things to be stopped, for no one would dream of running contraband cargoes of petrol, as it is rather a dangerous substance to carry in war time—so long as the Committee realise the fact that this very big industry depends solely on one fuel, and that that fuel might easily be put out of their way; and so long as they recognise that that is an argument in favour of doing everything that is possible, to allow what might be a home-grown trade and a home-made fuel to take its place, then I do not think it is necessary to go any further into this branch of the subject.

2089. (*Mr. Scott-Montagu.*) Assuming that there are 40,000 motor vehicles in this country to-day, which is not far short of the number, it may be perhaps a little in excess, but we will take it as an approximate figure, and, assuming that they each run on the average ten miles per day, which I think would be a fair average to take right through the country, though it is perhaps rather a low average, that would mean that they are are using 40,000 gallons, or 166 tons of petrol per day. One hundred and sixty-six tons per day is a very considerable consumption, is it not; and in time of war or in case of the supply being otherwise cut off, or even temporarily stopped, we should have motor cars, both those for pleasure and those for business, submarines and things of that sort, absolutely stopped in a very short time?—Yes. The submarines are absolutely dependent on the petrol supply. There is another point. I think it is obvious, and it has certainly been admitted by some naval officers, that in the future these very high speed small motor vessels—internal-combustion-driven motor boats, will in wartime play a very great *rôle*. A small boat, thirty feet in length, can move with so much velocity that a torpedo-destroyer has all its work cut out to keep up with it. What are these boats to look at? They are little things thirty feet long, they have about nine inches to twelve inches of freeboard, they make no noise, they can be made absolutely silent, they can be controlled by one man, and you can build forty to fifty of them for the cost of one torpedo boat. The whole of those things depend at the present moment on petrol.

Use of alcohol for motors a matter of price. It is too expensive now.

2090. (*Chairman.*) But there is nothing to prevent them at this moment using spirit, if they like, in all those cases, unless you are able to say that the methylated spirit is injurious; and of course, in the case of the Government, they can use anything?—There is no temptation for the motor builders, the people whem they will have to come to for their engines, to do the experimental work, and to put any time or money whatever into the building of alcohol engines, because they do not know that the fuel will be obtainable at a price which will make it a commercial business.

2091. If this Committee is expected to be able to put before motor builders some price at which they will be able to use alcohol, we shall never reach that point; because clearly the price of alcohol varies like anything else with supply and demand and so on. All we can say is, that we shall not attach to the use of alcohol for motor purposes any more onerous conditions than are absolutely necessary, but that the conditions must be more onerous than they would be in the case of enclosed factories is perfectly clear on the face of the matter?—Yes, that is so.

2092. Whether we shall be able to suggest conditions less onerous than those attaching to the use of methylated spirit seems to me rather doubtful; and it also seems to me rather doubtful whether the methylated spirit, as it is used now, would not really, it people built their motor cars for it, do perfectly well?—It is a question at present of price entirely. As I said at the beginning on the question of denaturing, in all probability it will do. It might be improved from the motor-user's point of view, but it is not an insuperable disadvantage. But on the question of the price, taking it as it is at present, say 1s. 10d. per gallon, or allowing for the ordinary small retailer's profit, so that you could buy it in small quantities at, say, 2s. per gallon, that is a price which will not tempt motor builders to start experimenting, unless petrol should happen to go up to 2s. per gallon, and then they will begin to look round, as usual, when it is too late.

Theoretical advantages of alcohol for motors as compared with petrol. (*See also* Q. 2114.)

2093. (*Mr. Scott-Montagu.*) It is true, is it not, that there are many advantages attaching to the use of alcohol amongst others, higher compression can be used, and therefore a better horse-power obtained out of a given weight of engine?—Yes. It is an undoubted fact that petrol engines cannot be built to work regularly and steadily with compression of more than about 80 pounds to the square inch; beyond that you get what is known as pre-ignition. With alcohol engines you can use up to from 10 to 15 atmospheres. The higher the compression you can work under, the bigger the percentage of heat units in the fuel which will be converted into work. Owing to a certain extent to this, it is a fact that alcohol engines have been known to give an efficiency of 38 per cent. of the heat units in the fuel which have been converted into work. I have never heard of a petrol driven engine which has given an efficiency of over 20·5 per cent., and the average efficiency of petrol engines may be taken to lie between 16 and 20 per cent. You can buy an alcohol driven engine in Germany to-day with a guarantee that it shall give you over 30 per per cent. of efficiency on a full load—in all these cases my figures refer to a full load. So that although on the face of it alcohol looks to be an unsuitable fuel, owing to its small heat value when it is burnt compared with petrol, the fact that you can get 50 per cent. more of the heat which it contains in the form of work done, tends to level matters up. Then another great advantage on the part of alcohol is this: that the mixture of alcohol vapour and air are explosive over a wider range than the mixture of petrol and air; that does not strike one at first as being of any particular importance, but it is of tremendous importance in the modern motor, because efforts are being made continually to make the modern petrol engines as flexible as a steam engine, so that by simply moving a throttle you shall be able to vary between any speed from four miles per hour to fifty miles per hour, without having to move and change levers, gears, and so on. The fact that you can work over a wider explosive range means that you can vary the power in your cylinder, and consequently the speed of your car, merely by letting more or less air into your cylinder along with your fuel. If you attempt to do that with petrol, you rapidly reach a stage where you have so much petrol that there is not enough air to burn it, or you have so much air there that the explosion is not perfect, That is a distinct advantage; however, I do not want to go into details too far; I wish to make it as short as possible. It was stated in that short article in the *Motor*, that it was a disadvantage that alcohol required more heat to vaporise it. I say that is an advantage, in so far as in any type of internal combustion engine you have a tremendous amount of energy wasted, because heat is wasted. With a petrol engine the difficulty is to carry the heat away. You have to use huge radiators with enormous surfaces, and fans drawing air through with powerful pumps to move the water round the cylinders to take the heat away, which is pure waste. You have to spend part of the poor little 15 per cent. which you get out of your engine in running pumps to remove the waste heat in the cylinder walls, which is work done where you do not want it. In the case of the alcohol engines there is a very much less percentage of heat goes into the wall., and therefore you do not want to remove so much. In addition to that, an alcohol engine gives the better efficiency when it is running hot than when it is running cold. So that you have not the same temptation to remove as much heat even did it exist. Then, again, you can easily spend a portion of that waste in supplying heat to vaporise the fuel. Now, alcohol requires 2½ times as much heat to vaporise it per unit of weight as petrol does, and the water in it requires 5 times as much. The consequence is you have a chain there somewhat resembling the old blast furnace and the modern one. The old blast furnace used to use cold air, but now-a-days they use some of the waste gases from the top of the blast furnace to heat the air, and the consequence is that in the end they use less fuel. It is so in the motor; you would use your carburettor as a regenerator to pick up the heat from the waste gases, spend it in converting your alcohol into vapour, and then you would burn your vapour in the engine

More work done per heat unit.

Alcohol-air mixture explosive over a wider range.

Less waste of heat.

Utilization of waste heat for vaporizing fuel.

More powerful and more regular explosion.

2094. And when you absolutely get your explosion in the cylinder, the dynamic force is greater and the expansion is more regular ?—Yes.

2095. That is to say, the diagram of the explosion is much more comparable to that of a steam engine, and therefore much more efficient in the way of work ?—Yes. In the case of petrol, when petrol and air combine they combine with tremendous rapidity, and a lot of the power of the explosion is spent in simply giving a blow. It is so sudden that the energy has not time to be transmitted to the moving piston. It is like trying to fire a gun with dynamite in it, instead of big grain powder. In the one case you would blow the breech of the gun to pieces probably, and in the other case it burns more slowly and the projectile is sent forward. The same thing occurs with alcohol. Owing to the presence of water, the high specific heat of the water has a tendency to reduce the temperature of the explosion, and this water, owing to its high specific heat, cools slowly and then—instead of the gas simply exerting a tremendous pressure and then slacking off immediately—owing to the presence of steam, which is a by-product from the explosion, you get a gradual expansion, and so you get a nice steady push of the piston, which more resembles a steam engine than an internal combustion engine.

2096. Providing you can get alcohol—I do not say any cheaper, but at the same price as petrol—in your opinion would alcohol be a more desirable fuel for an internal combustion engine ?—It would be distinctly more desirable theoretically, and the practical difficulties which exist I think simply exist because no skill has been used in attempting to overcome them.

2097. Do you consider that we are on the threshold of experiments with regard to the utility of alcohol for motor purposes ?—I should think distinctly that we are on the threshold. The little bit that I have been able to do myself has brought forth such interesting results that it seems to me there must be a very big field in front of us. There are the reduced fire danger, for instance, and the facts that the risks in the carriage of alcohol are very much smaller and the cost of distribution is much smaller.

Fire danger reduced.

2098. Railway companies, I believe, object at present a good deal to the carriage of petrol, do they not ? And they make special provisions for it ?—Yes. With regard to that point there is a letter in yesterday's *Star* referring to the danger on the river and stating that the Conservancy complain of a low flash cargo and at a meeting that day talked about the difficulty of obtaining an amendment of the Petroleum Act. That is because a vessel was up the river with a cargo containing a number of cases of petrol.

Smell less offensive.

2099. Then there is a less offensive smell from the combustion of alcohol than there is from the combustion of petrol, is there not ?—Yes. In no case have I been able to find an analysis of the by-products from the petrol engines which has not shown evidence of incomplete combustion, although there was a large excess of air present; but in the case of alcohol, the combustion, if the amount of air is anything like adequate and the compression is reasonable, is almost always perfect and you get no unburnt gases.

Benzol as a denaturant (*see also* Qs. 2142–56), from point of view of cost

2100. Supposing for the sake of argument that benzol is added to alcohol eventually, that would mean that there would be an increased demand for a very useful by-product of the coal tar industry, would it not ?—Yes. There has been a great deal of nonsense written about that same by-product. In regard to the price of benzol at the present time, I bought a quantity the other day, and I was quoted 1s. 2d. per gallon. I said: "I want something which will boil off at 95 degrees Centigrade; I do not care whether it is coloured, whether it is dirty, or what is the matter with it—it may contain what you like—but it must boil off at 95 degrees Centigrade." As I say, I was quoted 1s. 2d. per gallon. It would be useful to add it, but I do not see that there is going to be the slightest chance if any demand crops up of looking forward to utilizing benzol as a means of cheapening the average cost of mixing it with alcohol.

2101. What I meant to convey is this—that supposing, for the sake of argument, benzol is approved by the Inland Revenue authoities as being somewhat of a safeguard, to be used possibly with other safeguards such as colouring matters, if the difference in price between it and alcohol were such that we might hope to get it at what would not be an unprofitable figure, it would be a suitable thing to mix with alcohol ?—It could be easily obtained in such quantities as the Government would be likely to require it for denaturing purposes, if the prices were anything like the prices you would have to pay for petrol or alcohol.

2102. (*Mr. Tyrer.*) Would it better the efficiency ?—It is preferable to have just as much benzol present as will put into the mixture as many calories as the percentage of water present takes away, so as to bring up the amount of calories until it is equal to that of pure alcohol—that is, about 5,900 calories per kilogramme.

and from point of view of efficiency.

2103. I have here some figures by a French experimentalist, Monsieur Chauveau, who says that alcohol when carburetted gives 33 per cent. of efficiency, his other figures agreeing with those that you have given ?—That same gentleman found in one case, running an engine with pure alcohol with 10 per cent. of water, 38 per cent. of efficiency. By adding its bulk of benzol (which should have given a tremendous increase in the number of calories that he put into the mixture), he got a less efficiency. I do not however attach any value to the French experiments, for the simple reason that there are no records given of the amount of air that they used. These relative numbers are all right running with one fuel, but unless the carburettor was allowed more air when using benzol than when using a mixture without benzol, the figures could not be relied upon.

2104. That is, the results would not be strictly comparable ?—That is so.

Relative efficiency of alcohol and petrol.

2105. (*Mr. Scott-Montagu.*) What do you consider to be the relative efficiency of petrol and alcohol in point of the distances which they would drive a given car; have you got anything that you could give us on that subject ?—No, we have no data to go upon there.

2106. Will one gallon of alcohol drive your car further than one gallon of petrol, do you think ?—It all depends on the efficiency of your engine. If you have got an engine that is built for the purpose and has an efficiency approaching some of these I have spoken of—namely, 35 per cent.—you would get further with a gallon of alcohol under those conditions.

2107. As a matter of fact, at present, I think, one may say it is the other way ?—It is the other way; you use a slightly larger weight of alcohol in order to do the same amount of work.

2108. I believe the Minister of Agriculture in France has taken great pains to institute trials and races with alcohol-driven cars, because he considers it to be such a valuable fuel ?—Yes; they are using it as the Germans do to a certain extent, in order to encourage the growth of beet. It is due to their agrarian policy also.

2109. (*Mr. Nicholson.*) It is State-aided alcohol, in fact ?—Yes.

2110. (*Chairman.*) But as we stand at present, anybody using alcohol would probably have to use more than he would of petrol, owing to the imperfection of the engines ?—Quite so.

2111. (*Mr. Tyrer.*) How much more ?—There are no engines in existence in this country which are suitable for use with alcohol.

2112. (*Dr. Thorpe.*) Is that a fact ? Addressing myself for the moment to the remark which you have made, I may state that this question of the use of alcohol in motors has lately been before us in some correspondence we have had with Tangyes of Birmingham, who make alcohol-driven engines solely for a foreign market. They make them for Egypt, and they say that alcohol is the only fuel that they can use there. First of all, we required them to use methylated spirit. They demurred to that, but they did, as a matter of fact, use some on trials, and so far as we could make out it is about six of one and half-a-dozen of the other; but their point was that they wanted to be in a position to give a guarantee to the purchasers in Egypt that they were actually running these engines satisfactorily with alcohol, which the Egyptian Government alone could furnish them with. Whether Tangyes are in a position to give us the facts as to that, I do not know; but I may state that those experiments have

Dr. W. R. Ormandy.

6 Dec. 1904.

been made?—But those would be agricultural engines, would they not?—

2113. No, they are motors?—They would be agricultural motors; they would not be what are called high-speed motors, which is an entirely different trade. Tangyes do not make high-speed motors so far as I am aware. Their results would be for slow-running engines; and we have got any amount of that information. I can give you all the information that has been obtained on that subject in a country where there are already thousands of such agricultural engines running with alcohol—running every day and all day. It is to the effect that they are getting such an efficiency out of these engines that the actual volume of alcohol required would be practically identical with that of petrol. If high-speed motor engines can be built with the same degree of efficiency, it is highly probable that it will be possible to build a motor car which will run just as many miles on a gallon of alcohol as it will on a gallon of petrol.

2114. (*Chairman.*) But you do not expect to get better results than that?—That result has been obtained with perhaps four or five firms working on it who have not bothered probably to tackle the matter in the way which a motor car builder would, where efficiency counts for much more in his sales. It is highly probable that a very few years' practice would lead to a larger mileage in alcohol than it would in petrol. There is one other advantage—that you could get a larger number of calories, or you can get a larger amount of work, I may say, from a given cylinder capacity with alcohol than you can with petrol; but that is not generally known. If I were to have the choice now of making a Gordon-Bennett racer, I would prefer to back an engine that was running on alcohol, the engine being specially designed for the alcohol, rather than a petrol engine, because you can get a larger number of calories in a given cylinder capacity converted into work in an alcohol engine than you can in a petrol engine. That is an item of great importance, because the ambition of every motor car builder is to find an engine which, for a given size and weight, will give the largest possible output of work; and their efforts go more in that way than towards an absolute efficiency in consumption.

Alcohol gives more calories in given cylinder capacity than petrol.

2115. (*Mr. Scott-Montagu.*) For tropical countries there is no doubt, is there, that alcohol would be of enormous advantage?—Yes, because petrol cannot be used, and there are such tremendous objections to the use of paraffin oil.

Advantage of alcohol over petrol in hot climates.

2116. There is not, of course, any reason why you should not use petrol in hot countries as long as you take care; for instance, the Indian Government at the present time have relaxed their restrictions very largely, and allow petrol to be used in India, where it was not allowed to be used eight or ten years ago?—Yes, but it is a fact that unless you take considerable precautions you will find that your mileage of petrol, taken from one week's end to another, in India is apt to come out very low.

2117. Because of the evaporation?—Yes. That would make it distinctly a pastime for rich people in India

2118. Therefore, from that point of view, if you think that this country has got to build motor cars for the Colonies, it is even now desirable that we should be experimenting with alcohol engines?—Yes. The mere fact which has been quoted, that it is so largely used in Egypt is a sign of the times, and shows that it is a desirable fuel in hot countries.

Q. 2112.

Agricultural alcohol engines—no immediate future in this country.

2119. (*Sir W. H. Holland.*) May we take it that the owners of these agricultural engines you mentioned just now are interested in having alcohol at as cheap a price as possible?—In what sense do you mean interested?

2120 Are they not interested in having the alcohol which they use for driving their engines at as low a price as possible, and as free from taxation as possible?—I was referring to Germany. 2,700 or so are in use in Germany.

2121. You contemplate, I presume, that probably similar agricultural engines would become largely used in this country if alcohol were obtainable at the same price?—The conditions are somewhat different in this country to the conditions in Germany, in so far as coal gas is so widely spread here. There is no place of any reasonable size here but what has a coal gas supply, or where coal is not easily obtainable; and now-a-days you can get what they call an induction furnace in connection with a gas motor, which requires practically no looking after, and with which no alcohol, indeed no liquid fuel, can ever hope to compete so long as coal is at anything like its present price.

2122. Do you think there will be any sort of future for free alcohol for stationary engines here?—Not for stationary engines—not in the immediate future, at least.

Quantity of alcohol used for motor purposes in Germany,

2123. (*Mr. Nicholson.*) Could you give us the German figures in regard to the alcohol used for motor purposes, whether stationary or otherwise?—My memory is not reliable with regard to the point, but I believe in 1903, when there were only 770 users of alcohol motors in Germany—and now by the way there are about 2,700—in the four months, January, February, March and April, those 770 users consumed 211,000 gallons.

2124. Would those be bulk gallons?—That is pure alcohol.

2125. (*Mr. Tyrer.*) That is worked out at 100 per cent.?—Yes, absolute alcohol.

2126. (*Mr. Nicholson.*) Can you tell us the proportion that that bears to the total quantity used industrially in Germany?—That is about 600,000 gallons, which is about two and a half million litres for the year 1903. It is much more now.

2127. And that compares with what total quantity used industrially?—About 120,000,000 litres is the total quantity used industrially.

and number of motor engines.

2128. Bulk litres?—Yes. That 2,500,000 litres, although it is a mere flea-bite in the German production, is equal to a sixth of the total amount of methylated spirit used in this country for all purposes put together. It is probably very much greater now, because the number of motors going out is increasing, as it were, in geometrical proportion every year, and all the old ones still remain consumers. It is rather interesting to know what all these motors are used for. Here is a list made in 1903:—544 were used in agriculture; eighty-four were for pumping; sixty-three were for dairies; fifty-two were for generating electric light; fifteen were used by bakers and butchers; fifteen were used in brickyards; twenty-nine were used in machine tool and printing shops; eighteen in wood works; forty in grist mills; fourteen in building operations for hoists, etc.; fifteen for demonstrations and advertising; twenty were on boats; thirty were used on motor cars; and nine were alcohol locomotives.

2129. (*Chairman.*) Most of these apparently are stationary engines?—They were all stationary engines, excepting the three last.

2130. Where were those engines produced?—Practically all in Germany.

2131. By a single firm?—No, these motors are made by a number of firms, including Dürr and Deutz.

2132. Do those figures represent the total production of engines in Germany?—They represent the number of engines used in 1903 for alcohol only. The figure is much higher now—it is over 2,700 now.

2133. (*Sir W. H. Holland.*) The use of alcohol is increasing in Germany for that particular purpose, is it not?—Very greatly. Practically every small distiller in the land requires power, and it is convenient for them to use their home-made alcohol for power, except in so far as steam is necessary for heating purposes.

2134. (*Mr. Nicholson.*) You have already told us that that alcohol is obtained below cost price; and therefore its use cannot be contemplated, so to speak, in this country?—Below the cost price in Germany, but that is not of necessity below the cost price of production in this country, which is rather a different statement. All these figures relating to alcohol are much more readily obtained if you buy the Calendar issued in connection with the industry.

Alcohol for light and heat in Germany. Quantity used.

2135. (*Chairman.*) I notice in the Return which we have showing the duty free spirit used for industrial purposes in Germany, that a quantity of nineteen million bulk gallons of pure alcohol is entered as being for general use. Could you tell us what the purposes are which are covered by that term "general use"?—General use includes all alcohol sent out which is denatured with the general denaturant.

2136. Therefore, being completely denatured with the general denaturant, they would pay no further regard to it after it had once been issued?—That is so. Statistics are obtainable owing to the fact that the whole of this material is distributed by the Centrale, so that we can find out to a large extent pretty accurately in what directions these nineteen million gallons have been used.

2137. (*Dr. Thorpe.*) May we not take it, roughly speaking, that it is used for the purposes of lighting and heating?—Practically the whole of it is used in lamps for illuminating and also for heating.

2138. It is practically all used for household purposes?—Yes.

2139. (*Mr. Tyrer.*) How does that agree with some figures that I have got here, which I brought home from America? These figures give the production and the consumption of alcohol during six years, the last year being 1902, and therefore approximately near to your dates. They give the production as 223,899,120 proof gallons?—It is rather awkward to divide it over six years, because the industrial uses of alcohol have had such a tremendous growth over the last six years.

2140. I am not giving you the average figures, but I am giving you the figures for 1902. The duty-free spirit denatured amounted to 58,632,840 proof gallons, and the tax-paid spirit amounted to 125,488,594 proof gallons. I notice there is some discrepancy between the figures which have just been read and these, and I would ask you whether you can explain it?—I cannot explain it. These figures which have just been referred to by the Chairman are official figures, and agree perfectly well with figures which I got from the Centrale, who in the first place supplied them to a large extent.

German Centrale—its method of working. (*See* Q. 1085, etc.)

2141. (*Mr. Nicholson.*) The last time you were here you told us that the German Government returned thirty-seven million marks from their taxation on alcohol to the makers. May we take it that that is substantially the sum that is devoted to cheapening the number of gallons used for industrial purposes?—Without knowing the interior or working of the Centrale, it is impossible to answer that question. They pay the maker of the alcohol a certain sum, and they sell some of it to the distillers, or to—what shall I call them?—the compounders; that is, the men who compound them into potable liquids, and it is sold to them at various prices according to the quantity which the compounder consumes, and according to the state of the alcohol market. They get for that a certain sum, and they get a certain sum of money back again from the Government, and they arrange the prices which they charge to these compounders in such a way that after supplying the industrial user at a fixed price, they shall just make ends meet. So that the whole question as to how much money is actually used in cheapening industrial alcohol could only be told after very careful investigation of the papers belonging to the Centrale, which, I question very much, whether they would allow you to look at. The difficulty arises from the fact that the reduction in cost depends on two factors, one the money which they get back from the Government, and the other the surplus above the average price which is charged to those who convert the alcohol into potable liquids.

See Q. 2100.

Crude benzol as a denaturant for motor spirit. Question whether its impurities, while not affecting the suitability of the spirit, would serve as a protection to the Revenue. (*See also* Qs. 2019-26.)

2142. (*Dr. Thorpe.*) You have quoted a boiling point for the benzene, or benzol as you have called it, which you would use in connection with your alcohol if you had the opportunity of using it, and the boiling point which you have quoted is 95 degrees Centigrade?—Excuse me, I mentioned that figure in connection with a query that was put with regard to the price of benzol. I stated that having a requirement for a considerable quantity of benzol of that particular boiling point, I found that I had to pay 1s. 2d. per gallon. That was merely a statement for the purpose of giving some idea as to the approximate cost of benzol, and it was not made with any view of alleging that benzol, of that particular boiling point, could be used in connection with alcohol.

2143. That is the point. I was very much interested in that, because, as you know, "benzol," which burns at 95 degrees Centigrade, is very far from being benzol?—That is true.

2144. My experiments, which I have made as to denaturing, have been made with substantially what is called benzol; but if I am allowed to incorporate in that such a large quantity of toluol and other hydrocarbons, which a boiling point of 95 degrees Centigrade means, then I am incorporating something very different as a denaturant, am I not?—That is so. Taking pure benzol mixed with alcohol and water and comparing that with toluol and xylol, the differences, considering the difference in the boiling point of the hydro-carbons, are very slight indeed. I have been carrying out systematic experiments with each one of these three, under the same conditions in each case, in order to see how they differ relatively from one another in their action with regard to mixture with alcohol and water.

2145. Have you had any regard to the nature of the spirit, which may be separated by dilution with water from so crude a hydro-carbon as you indicate?—No. It is no use making experiments with substances of mixed composition. It is necessary to work with the pure ingredient such as benzol, toluol, and xylol, and then to draw conclusions as to what would happen with the mixture.

2146. I am looking at it from another point of view. I was assuming that we could come to some agreement as to the nature of the hydro-carbon which has necessarily to be used in conjunction with this. Could I, by experiment, assure the Board of Inland Revenue that no matter what these people connected with the cars did, their residual diluted spirit would still remain unpotable? When I can use a large proportion of xylol and toluol in that, to the exclusion of the benzol, then I am getting a very different product in the aqueous spirit than I had before?—I do not see that the composition of the aqueous spirit will vary much.

2147. My point is, that the smell of it and the flavour of it will vary that it will be practically unpotable or may be?—I hope it could be, but so far, in order to get a mixture which will boil off at a reasonable temperature, that is, without leaving residues boiling at 180 degrees Centigrade and so on, it has been necessary to buy what is known as commercial 50's/90's benzol, but 50's/90's benzol has not got any more disagreeable smell than a mixture of pure benzol and pure toluol has as a general rule. In the distillation, in order to get what is called 50's/90's benzol, the crude products are treated with caustic soda and acid in such a way as to remove the smelly ingredients.

2148. That is the point?—Whether that is necessary or not, I do not know. I am myself trying at the present time to get large quantities of crude benzene containing smelly materials—it does not matter to me what they are, but there must be no solid residue. That is the identical material which the motor user would like to have; it must not have a solid residue, but the smelly materials present do not matter.

2149. Apparently they are taken out under the present system, you say?—They are.

2150. That is the whole point. If you come forward to the Board and ask to be allowed to use a denatured alcohol, surely it is worth your while to make experiments with this crude hydro-carbon which has not been partially purified from impurities which do not matter to you for motor car work? If you can show us that with that impure hydro-carbon (with all its smelling things, which give such a flavour to the spirit) when the whole is diluted with water, a stink still hangs about it and nothing can be done with the diluted alcohol in the way of making it potable, then you will have solved the difficulty?—It is in that direction I am working; and I think you will agree with me that it is necessary to carry out the experiments with individual pure products in order to get data that you can go upon.

2151. That is as regards the economic effect, but it is for you to find out whether it is worth while to do it. That is not our point of view; our point of view is, that when you have done all that, we must be protected?—Yes; and what you also do want to know is this—having added a certain percentage of benzol, you want to know what result happens by the addition of its own bulk of water; do I get all the benzol separated and all the alcohol and water left behind, or does the mixture still contain some benzol, and consequently, has it still an unpleasant taste and smell?

Dr. W. R. Ormandy.

6 Dec. 1904.

2152. (*Mr. Tyrer.*) In other words, does the alcohol stink ?—Yes.

2153. (*Dr. Thorpe.*) I should not ask you what it contains and I do not care what it contains ; the point is, is it drinkable ?—Yes.

2154. (*Sir W. H. Holland.*) And is it smellable ?—Yes. But what is drinkable is something that is not susceptible of a scientific definition.

2155. (*Mr. Tyrer.*) I have experimented with this and have found that it separates out exactly as Dr Thorpe has described, but I have not had the crude stuff which you have been talking about ?—You cannot get a crude material without having a solid residue, and when you take the solid residue out of it, unfortunately it takes the smell out. We want the residues removed, but we want to retain the smell.

2156. About what percentage does the residue amount to ?—It varies with every different gasworks. I have found 50 per cent.

2157. (*Sir W. H. Holland.*) Do you know anything about the artificial silk industry ?—I do not know anything about that.

Mr. Tom Gardiner, called ; and Examined.

Mr. T. Gardiner.

6 Dec. 1904.

2158. (*Chairman.*) You are manager in the firm of Messrs. A. Lambley & Sons, Birmingham, are you not ?—Yes.

2159. They are lacquer and varnish makers ?—They are manufacturers of lacquer, and of spirit varnishes as well.

Lacquers. Pure spirit lacquer not preferred to to that made with Methylated spirit except for exceptional purposes.

2160. Is yours a firm of old standing ?—Over fifty years.

2161. In their works they of course use spirit ?—Quite so.

2162. I understand that it is methylated spirit that they use ?—Yes.

2163. Do they always use methylated spirit ?—Not always. Sometimes we use pure spirits, but that is in very isolated cases.

2164. Is that done by special orders ?—Special orders and special requirements.

2165. For what sort of things are those special orders given ?—For very fine instrument work.

2166. Are you satisfied that a distinctly better result is produced by using pure spirit ?—In the general way of trade it is not.

2167. What is the difference, do you find, as between a lacquer which is made with pure spirit, and a lacquer which is made with methylated spirit ?—A lacquer which is made with methylated spirit, that is, with a pure grain spirit, methylated with a good quality of naphtha, in a general way is far preferable to a lacquer which is made with pure spirit, owing to its very fine solvent properties, which you cannot get in the pure spirit unless you get a pure spirit of a very high proof, which is almost a prohibitive matter.

2168. In the case of these finer lacquers, when you are asked to use a pure spirit, what is the effect on the lacquer ; in what way is the lacquer, which is so produced, superior to the lacquer which is produced with methylated spirit ?—There is an advantage in using pure spirit in some ways, and there is a disadvantage in other ways. There are some people who object to the odour of naphtha and they require you to make a lacquer with pure spirit in order to avoid that odour. But in regard to the durability of it, we can trace nothing in its favour at all.

See Qs. 1835-50.

2169. We had a witness before us last week who was a user of lacquer ; he gave the Committee to understand that lacquer made with pure spirit was better than lacquer made with methylated spirit, for two reasons—first, because it was considerably brighter and there was an entire absence of what he called iridescence on the article that was lacquered, and secondly, to which he attached still more importance, lacquer made with a pure spirit maintained its brightness for a much longer time than lacquer made with methylated spirit ?—We have proved it differently.

2170. You do not agree with that ?—We should distinctly say that that was incorrect. One of the largest brass founders in the Midlands, Messrs. James Cartland & Sons, Limited, very old customers of my firm, used to have pure spirit lacquer from us, and we supplied it for a great number of years up to two years ago.

2171. In large quantities ?—I will not say in large quantities, but perhaps 20 per cent. of their general orders was for pure spirit lacquer. They discontinued its use, and now they absolutely prefer a lacquer that we supplied them, which is exactly the same only it is made with methylated spirit.

Price of the two kinds of lacquer compared.

2172. What is the difference in price between a lacquer made with pure spirit and a lacquer made with methylated spirit ?—One would be about 24s. to 25s. per gallon, and the other would be about 5s. 6d. per gallon.

2173. You gave just now, as a reason for people ordering pure spirit lacquer, that some people objected to the smell of naphtha ; surely the smell of naphtha in the methylated spirit could hardly be detected in the lacquer when finished, could it ?—Not when finished. It can only be detected at the time of its being applied ; not afterwards.

2174. After it has been applied to the lacquered article you would have no smell from the wood naphtha ?—Not any at all.

2175. I understand that the firm that you represent have no particular desire to be allowed to use pure spirit ?—None whatever. We should still have to use naphtha, no doubt, if we had the permit to use pure spirit.

2176. You would still go on with it ?—We should still use it for certain solvents.

Risk of misuse of pure spirit if used for making lacquer.

2177. Do you see any objections to the use of pure spirit, apart from the fact that you think you prefer methylated spirits ?—I see an objection in this way—that it would probably lead to dishonesty in regard to the employees. If they could get the pure spirit they would make an improper use of it, and it would be very difficult to keep it out of their hands. There are some of them who would be tempted now with the methylated spirit. I am speaking of our own trade and the allied trades.

2178. In the process of manufacturing lacquer, the workmen have not much opportunity, have they, of getting the spirit until it has been mixed in the bath with the shellac and colouring matter ?—Yes, they have a means of getting to it. We have to hold our spirit in vats and you cannot put that spirit straight into the gum.

2179. But you could if you had the proper mechanical appliances, could you not ?—You could do so then, certainly, but it would be a big hindrance and a nuisance to do so.

Process of manufacture.

2180. As a matter of fact, how do you now add the spirit to the solution ?—It is simply put into the vats and then we put the gum to it in certain quantities according to the different grades and qualities of the different gums.

2181. Then the solution with the spirit in it remains for some weeks, does it not ?—Yes.

2182. In the process of manufacture, you mix your gums and your colour and your spirit in a bath which is oscillated, I believe ?—No, there is no movement whatever. it is perfectly stationary. The spirit gradually dissolves those gums down and it gradually fines down. The colour is afterwards added.

2183. Is not the solution stirred from time to time ?—Not unless you want to dissolve it rapidly.

2184. How long does the process take ?—That varies with the various grades of gum. There are some gums which are very much softer than others. Take a lacquer that is made with shellac, there is a certain percentage of resin in shellac ; that would go down or dissolve in a much quicker time than the natural gum of the tree.

2185. Would that be a matter of weeks ?—That would depend on the temperature a good lot. Supposing it was in a warm temperature, it would go down very much more rapidly. With regard to the variance of temperature such as we have had last week, we can never tell or judge how long it will be, or when we can get it to the proper solution.

2186. You have a vat full of methylated spirit ?—Yes.

2187. If you are using pure spirit, the vat would contain pure spirit ?—Yes.

2188. Then you would begin your manufacture of lacquer by adding the gum ?—Yes.

Pure spirit not rendered impotable by addition of gum. (*See also* Qs. 2260-7.)

2189. When the gum is put in, at first it would be some little time before it began to influence the spirit, would it not ?—Yes.

2190. Therefore, for some time after you began the manufacture of lacquer, the spirit would be drinkable if a man could get at it, because the gum has sunk down to the bottom ?—Most decidedly; and it would also not be harmful either, so far as the gum ingredient was concerned. It is not denatured by the admixture of gum.

2191. Might it remain for a week, for instance, fairly potable ?—It would probably remain for quite a week in the ordinary way; but that, of course, depends, as I say, upon the different grades of gum. There are some gums that would go down in an hour.

2192. Take shellac ?—With shellac it would not be fit for lacquer making for three or four days probably.

2193. Shellac takes that period to dissolve ?—Quite.

2194. Meanwhile the spirit on the surface of the vat would be quite drinkable ?—Yes; but it would have a certain portion of the gum in it five minutes after the shellac was added.

2195. But not enough to make a difference ?—It would be a very small percentage of the gum, and it would be quite drinkable as far as any harmful effect was obtained. What I wish to convey to you is this: that it would be no more harmful than tincture of benzoin, which is a solution of gum benzoin.

2196. Now you say that you do use a certain amount of pure spirit in the manufacture of lacquer ?—Yes.

2197. Could you give the Committee any idea of what number of gallons of pure spirit you use in the course of the year ?—The last time we paid duty to you was, I think, about three years ago, and that was on a 30-gallon cask. I daresay we have got now ten or fifteen gallons of it in stock.

2198. Then the quantity is practically immaterial ?—It is a very small percentage.

2199. There you simply use a plain spirit of high strength, I suppose ?—Quite so; about 65 O.P.

Precautions necessary with pure spirit.

2200. Would you take any particular precautions to prevent its being tampered with by your workmen ?—We take every precaution with regard to that. Of course we can pretty well tell by our stocktaking whether there is any very great depreciation in the quantity. We have to allow a good deal for evaporation, and we have to allow a good deal for leakage as well. We have never found anything of the kind with our people; they are all old servants and all trusted servants.

2201. Still, if you were allowed to use pure spirit generally you would have to do something to protect it ?—Yes.

2202. And a certain amount of Excise supervision would therefore be necessary ?—It would be absolutely necessary. Not so much perhaps in regard to our particular trade as in regard to the allied trades. Take for instance the big furniture places which make French polishes. They are big users of methylated spirits, and supposing there was a privilege allowed to use pure spirit they would no doubt have that privilege, and the spirit would then get into the hands of a tremendous lot of women, whereas in our own trade it does not come into the hands of females at all.

Potability of lacquer made with pure spirit (*See* also Qs. 2260-7).

2203. Is there any lacquer or varnish which you make, which if it were made with pure spirit would be tolerable to drink in the form of lacquer or varnish ?—Yes.

2204. And not injurious to health ?—Not in the slightest degree. I do not say that it would do them good. It would no doubt do them no harm. The spirit would be of a very raw nature to start with, because it would be a new spirit. But as far as the gum properties were concerned, they would not in my opinion do them any serious amount of injury.

2205. Then in fact some of your lacquers or varnishes might be spirituous compounds which could be drunk without great injury to health ?—Quite so.

2206. And possibly might with a little doctoring be made fairly tasteful ?—Quite so. If an employee was dishonestly inclined, and he had a very little technical chemical knowledge, he could, of course, separate that alcohol or pure spirit from the gum, simply by a distillation process.

2207. Most of your products as sold contain more than gum; they have also got colouring matter in them ?—Yes, and those are mostly quite harmless.

2208. Which ?—Ninety per cent. of our colouring matter is harmless. I am speaking of my own firm now, not of others.

Present system preferred by witness's firm.

2209. Speaking for your firm, you are prepared to say that you would prefer the present system, under which you use what is called ordinary methylated spirit, to a system under which you are permitted, subject to Excise supervision and some restraints, to use pure spirit ?—Undoubtedly.

Preference not shared by the trade as a whole.

2210. Do you know whether that view of the firm of Messrs. Lambley is shared by other members of the trade ?—Yes, by one of the largest; that is Llewellyn Rylands, Limited.

2211. Are they a Birmingham firm ?—Yes, and one of the oldest firms.

2212. Are they in agreement with Messrs. Lambley ?—Yes. I went to see Mr. Rylands before my visit here.

2213. (*Dr. Thorpe.*) Have you his authority to say he agrees with you ?—Yes.

2214. You have his authority to say you represent him ?—Yes, I represent him. I submitted to him a *precis* of the evidence that I submitted to you.

2215. (*Chairman.*) What should you say was the opinion of the lacquer and bronze trade generally on the subject; would the opinion you have expressed be the general opinion, do you think, or would the opinion be the other way ?—I could not go that far, because there are a lot of small makers that we really do not take very much notice of. I took the largest in the trade and the oldest ones.

2216. Has not the subject been discussed in any trade association or trade journal ?—It has been brought to the notice of the Birmingham Chamber of Commerce by a man who has only recently been associated with the trade; and I believe he has been pressing and pushing the matter forward for the use of pure spirit. What his reason or motive is I cannot give you.

2217. (*Dr. Thorpe.*) Are your firm members of the Birmingham Chamber of Commerce ?—The firm is not.

2218. Are the other firm you quote members ?—No. I think the motive was to endeavour to get the basis ingredient, which is spirit, at a lower price per gallon than it is now. I think that is the only motive.

2219. (*Chairman.*) Or the principal motive ?—Yes.

2220. (*Sir W. H. Holland.*) It is a very common business motive, I am sure ?—I do not think it would do the trade generally any good. It might be an additional incentive to the cutting down of prices.

2221. (*Chairman.*) Is the manufacture of lacquer located in any one place or in any two or three places; for instance, is Birmingham a great centre ?—It is the largest.

2222. Is there much in London ?—There are only one or two here that I know of.

2223. You probably would know the principal people in the trade ?—Yes.

2224. How about the north ?—I do not know of any in the north.

2225. That does not mean that there may not be some ?—No, I will not go that far. I only say I do not know of any.

2226. You do not know of any people in a big way of business as manufacturers of lacquer in Manchester, Leeds, Newcastle or any of the other great northern towns ?—No, I do not. There is one in Manchester in the lacquer trade. It is not in the hot lacquer trade, it is in the cold lacquer trade.

Mr. T. Gardiner.

6 Dec. 1904.

2227. Does that require spirit at all?—Yes, it does require spirit, but it requires a spirit altogether different to a pure grain spirit or methylated spirit.

2228. (*Dr. Thorpe.*) It requires fusel oil, does it not?—Yes.

Cold lacquer made without alcohol except fusel oil.

2229. And only fusel oil?—No, amyl acetate, or pear oil as well.

2230. (*Chairman.*) Do your firm make any cold lacquer? Yes.

2231. Do you use spirit for that?—Yes, but not methylated spirit.

2232. What spirit do you use?—What I have just stated

2233. (*Dr. Thorpe.*) That is a mixture of amyl alcohol and amyl acetate?—Yes.

Successful competition in foreign markets.

2234. (*Chairman.*) Is the business of your firm to any extent an export business?—Yes, we do a considerable export business all over the world.

2235. Do your goods obtain a market on the Continent?—We have a very big customer in Germany, and we have customers in France. Of course, we are in competition with French and German makers.

2236. (*Mr. Tyrer.*) Do you sell them the cold lacquer or the hot lacquer?—Both. We also export to Canada and the States.

2237. Do you cut your prices down in order to get into the German market?—No.

2238. Then they give you your own price?—It is not a matter of price.

2239. (*Mr. Tyrer.*) Do they put a duty on?—There is no doubt a duty goes on, but I could not tell you what it was.

2240. (*Sir W. H. Holland.*) That is because you do not pay it?—We do not pay it, because you see it does not go through our hands at all. We ship through merchants.

2241. (*Mr. Tyrer.*) Do you happen to know, apart from your own experience, whether there is a duty?—I should think there was, but I could not tell you for certain, and I would not like to make a statement, if I was not absolutely certain.

2242. (*Dr. Thorpe.*) Do you think the duty is on both forms, hot and cold?—It would be on both, I should say.

2243. Why should they put a duty on fusel oil?—They perhaps do not know the ingredients of it.

2244. (*Chairman.*) You do not find that you have to cut your prices for Germany below what you charge in this country?—No.

2245. You can command the same price there as here?—I can get a better price there.

2246. How do you account for that?—Some of the French makers get an enormous price for their stuff. In France it is really a matter of price and quality with us.

2247. Do you do a large business in France?—Yes, we supply a lot of stuff to the bedstead trade there.

2248. (*Mr. Tyrer.*) Is more fusel oil used than amyl acetate, or *vice versâ*, in cold lacquer?—More fusel oil is used.

Use of pure spirit not regarded as a real benefit in view of increased supervision it would entail.

2249. (*Mr. Nicholson.*) I do not quite understand your position in the matter: what is your objection to others being allowed to use pure spirit; you would not be compelled to use it?—Certainly not. Our objection is really a very slight one, but we cannot see any real benefit in it. The objection, principally, would be that in our opinion the extra supervision that would necessarily be brought about, supposing pure alcohol was allowable, would be very great. As methylators of spirit we know a little in regard to what excise supervision is, perhaps more so than our competitors who have not that licence and privilege.

2250. (*Dr. Thorpe.*) Are you, yourselves, methylators?—Yes, although we are only methylators for our own specific trade use, and do not methylate spirit for sale.

2251. (*Mr. Nicholson.*) If you do not propose to use pure spirit, you would not be subject to any greater Excise supervision than you are at present, would you?—We think differently. We think that to protect the Revenue, it would be bound to be supervised in a very stringent form.

2252. Is that really your object in coming here to-day?—That is one of the objects. As I have stated, we cannot see any real benefit, supposing pure spirit was allowable.

2253. If that did not affect you from the point of view of Excise supervision, there is no reason why you should object to other people being allowed to use it, is there?—I am only speaking of our own trade and the allied trades, not the others.

2254. (*Dr. Thorpe.*) I presume you foresee that more Excise supervision would be required, from the very nature of the article with which you are dealing?—I do.

2255. And you say that you think it would be absolutely necessary for the protection of the Revenue?—I do indeed. I do not see how the Revenue can be protected unless some very stringent rules are laid down.

2256. (*Mr. Nicholson.*) It is being protected now on your premises?—Quite so.

2257. But if you do not propose to alter your method of manufacture, there would be no need for the Excise to put any increased supervision over you?—I am not speaking now, perhaps, of ourselves. I am speaking, perhaps, of others in our trade and the allied trades—the furniture trades, for instance.

2258. (*Dr. Thorpe.*) Your point is this, if I gather rightly—you think the methylated spirit practically takes care of itself?—Yes, I do.

2259. Therefore, the supervision in the case of methylated spirit, although you have it, is not so stringent as the supervision would have to be in the case of pure alcohol; that is your point?—That is my point and opinion.

Risk of misuse of pure spirit. (*See* Qs. 2189–95 & 2203–8.)

2260. (*Mr. Tyrer.*) I understood you to say that you had a fear that if pure spirit was used it might be drunk?—Yes, I have.

2261. Have you ever heard of any attempts to separate or to treat in any way the methylated spirit for the purpose of drinking it?—You cannot separate it when once it is methylated. When I say you cannot, I mean I do not know of any method.

2262. I am speaking of the mixture. I may be wrong, but I think I heard you say that one of the dangers was that if you used pure spirit after the separation of the insoluble portion of the gum, the upper portion might be misused, even directly by separation with water, and you also said that it might be distilled?—Pure spirit could be.

2263. They would have to rob you to do that?—Quite so. The pure spirit could be easily separated from the gum.

2264. Why do you think that you could not sufficiently trust your old servants? You said you had a number of old servants; do you not think they could be let alone?—I think those that we have at the present moment I could trust with anything.

2265. But you do not seem to have very much confidence in the women?—No, I have not, most decidedly.

2266. (*Sir W. H. Holland.*) Do you think they are worse than the men?—I know they drink methylated spirit now.

2267. (*Chairman.*) Do you think they really do?—I am quite certain of it.

2268. (*Mr. Tyrer.*) When you speak of the allied trades, what trades do you include in that term?—The manufacturers of varnishes. We are not varnish makers, we are lacquer makers.

2269. But you think the same objections that you have would apply in the case of the spirit varnishes?—I do.

2270. (*Chairman.*) Do you mean that you do not make what is commonly called varnish?—No, we do not. The varnish trade means oil varnishes in the proper sense of the word. We do make varnishes, but we call them spirit varnishes, and we do not call ourselves varnish makers.

Fusel oil as a denaturant in lieu of wood naphtha. Not regarded as suitable for hot lacquers.

2271. (*Dr. Thorpe.*) Supposing we were to cast about for some cheaper form of denaturant, do you think from your knowledge of the properties of these materials, that a portion of the wood naphtha might be replaced by fusel oil when making hot lacquers?—No.

2272. You do not think so?—No, you could not do so.

2273. Why ?—Not without spoiling the solution for a hot lacquer.

2274. Has that been tried; do you speak from experience ?—I speak from my own trials of it.

2275. You have tried to substitute fusel oil for wood naphtha ?—I have.

2276. And you found that it has not been successful ?—No, it has a very bad effect.

2277. (*Mr. Nicholson.*) Is there any substitute for fusel oil in the case of cold lacquer ?—Yes, we make a cold lacquer without fusel oil, and I am experimenting now upon one without fusel oil.

2278. Because of the price of fusel oil ?—Yes. A deodorised mineral naphtha will take its place to a certain extent. That is known as benzine.

2279. (*Dr. Thorpe.*) You mean petroleum benzine ?—Exactly. Mineral naphtha will take its place to a certain extent, as I say. The fusel oil plays a very prominent part in the manufacture of cold lacquer for two or three reasons. It stops chilling, for one reason.

2280. (*Mr. Tyrer.*) Is that what is called "fogging" ?—Exactly so, but we call it in the trade, chilling. Another reason is that it holds the gums or compounds in solution better; it holds them down, if that will better explain it.

2281. In addition to the acetate of amyl ?—Quite so; but I can make cold lacquer without amyl acetate or pear oil.

Use of methylated spirit not regarded as prejudicial to durability of lacquer.

2282. (*Dr. Thorpe.*) Do you find any inconvenience to arise from the fact that methylated spirit by age tends to darken in colour ?—No.

2283. Then that is not an objection ?—No—unless it is a spirit methylated with naphtha of a very vile nature.

2284. With ordinary methylated spirit, such as you can control yourselves and make yourselves, there has been no objection arising from the fact that it slowly darkens by age ?—No.

Mr. T. Gardiner.

6 Dec. 1904.

2285. (*Mr. Tyrer.*) Are you compelled to use the wood naphtha which you buy for methylating according to the specification of the Excise ?—Certainly. We submit samples for your certificate, it is deposited, and then it is under Excise lock and key.

2286. I was wondering whether it was a case where very crude naphtha was employed, or do you have to use the regulation naphtha ?—We are a little bit at cross purposes I think. Somerest House will pass any vile naphtha—the viler the better. Supposing we submitted to you a very pure naphtha, it is possible that you would say "This will not suit us."

2287. So the worse the better ?—The worse the better, from your point of view.

2288. (*Dr. Thorpe.*) You are surely familiar with the present regulations ?—That is according to the present regulations.

2289. You know what they are, and you buy your naphtha to accord with the present regulations ?—Quite so.

2290. Where do you get your wood naphtha from ?—From the Pontithel Chemical Company, Limited.

2291. Is that British made ?—Yes. They are at Credenhill, near Hereford. I have had many samples submitted to me, but I have not been able to beat theirs.

2292. (*Chairman.*) Could you tell us roughly what quantity of spirit you use in the year ? Is it between 10,000 and 20,000 gallons ?—I could not give it you exactly. I should say, roughly speaking, it is 1,200 gallons per month.

2293. That would be about 15,000 gallons per year ?—It would be something like that. The last contract I signed was for 20,000 gallons of spirit.

2294. But not all to be supplied at once I presume ?—No, it is to be supplied as we want it. We never methylate less than 500 gallons at a time, and of course we are not allowed to methylate less than 450.

EIGHTH DAY.

Wednesday, 7th December, 1904.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair*).

Professor Sir WILLIAM CROOKES, F.R.S.
The Hon. J. SCOTT-MONTAGU, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*).

Captain THOMAS GREGORIE TULLOCH, late R.A., called; and Examined.

2295. (*Chairman.*) You represent the Chilworth Gunpowder Company, do you not ?—Yes.

2296. What position do you hold under the Company ?—I am the technical manager.

2297. Have you held that position for some time ?—Only for a year this month.

2298 Prior to that, you were in the Army ?—Yes. I was Secretary of the Explosives Committee, of which Lord Rayleigh is President, since its inception in 1900.

2299. That Committee is still sitting, I believe ?—Yes.

Nitro-cellulose powders (lower nitration). Ether-alcohol as a solvent.

2300. Would you explain to the Committee exactly in what way alcohol or ether enters into the manufacture of military powders ?—Yes. In all powders which contain nitro-cellulose with the lower nitration, it is necessary to use as a solvent a mixture of ether and alcohol. It is impracticable in those powders to use acetone as a solvent, as that makes the powder too brittle. We have on several occasions attempted to use acetone as a solvent, but the result is that a powder is made which is altogether too brittle for practical purposes, and the consequence is that we have to have recourse to the ether-alcohol solvent.

Capt. T. G. Tulloch.

7 Dec. 1904.

Acetone for higher nitration powders (Cordite).

2301. But you do use acetone for certain powders, do you not ?—We use acetone for those powders, into the composition of which enter the higher nitration gun cottons. For instance, cordite contains nearly all insoluble gun cotton, and for that you use acetone. It does not seem to affect it in the same way as it does the lower nitration cottons. If you use acetone with the higher nitration cotton, the result is not so brittle as when you use the acetone with the lower nitration cotton.

Lower nitration powders must now be procured from abroad.

2302. Have the lower nitration powders, which require large quantities of alcohol and ether, to be procured from abroad under the present circumstances ?—Under the present circumstances, yes. There are very few powders,

Capt. T. G. Tulloch.

7 Dec. 1904.

except sporting powders, now made in England with the lower nitration cotton in which ether-alcohol is used as a solvent. Investigation and manufacture on a large scale are practically stopped, owing to the high price of alcohol and ether in this country.

2303. As a matter of fact are the War Office importing large quantities from abroad?—No, the War Office are not importing them, because they do not use these powders with the low nitration. They only use the cordite.

2304. Is that on account of the price?—No. We had a large trial of nitro-cellulose powders against cordite, and the cordite gave better keeping qualities all round than the nitro-cellulose powder. It should be remembered in this connection that our powders have to go to all parts of the world; for instance, to North America, where it may be frozen, and to the Straits of Malacca, Singapore and so on, where it is subjected to a very damp, hot climate. The consequence is that we have been forced to adopt a powder the main characteristic of which is good keeping qualities.

Orders from foreign Governments lost to English manufacturers owing to high price of alcohol.

2305. You say in your *précis* that many hundred thousand pounds worth of orders for artillery powder have in the past few years been lost to this country; but I rather gather from what you have just said that the War Office have not been desirous to get powder of the kind which you have described?—I was referring to foreign orders in that case. There are a very large number of countries which have no powder works of their own—at least they have not had hitherto; and naturally they look about to those countries which manufacture powders to supply them. There are a very large number of these countries which use pure nitro-cellulose powders, and the consequence is that the whole of their orders go to countries where nitro-cellulose powders can be produced without prohibitive cost.

2306. I understand that the present position as regards alcohol does militate against any possibility of manufacturing these particular classes of powder in this country for foreign Governments?—Yes, that is so; it militates very considerably against it. So far as English ordnance factories are concerned, we constantly have very large inquiries for nitro-cellulose powders, which we are not able to fulfil, owing to the high price of alcohol.

2307. When you speak of the high price of alcohol, do you mean the high price of alcohol independently of the duty?—Yes, as compared with the price that the Germans can make it at.

2308. As regards any question of the duty since 1902, you could have been relieved from, not perhaps the indirect effects of the duty, but the actual duty certainly, on the alcohol you used, whether you used the alcohol directly, or whether you used it for the purpose of converting it into ether to be afterwards used, could you not?—Yes. I believe the Board of Inland Revenue have been most anxious to meet us in every way; but we cannot purchase it from the manufacturers at the same price that the Germans can buy it.

A War Office order for smokeless powder. Cost of material compared with the price offered.

2309. (*Mr. Scott-Montagu.*) What is the price that the English alcohol manufacturers charge you?—7½d. per pound. Perhaps in this connection I might read a letter which I addressed to the Secretary of the Board of Inland Revenue in May last:—"Sir,—In *The Times* Parliamentary report of 14th May under the heading, 'Questions not answered orally,' the Chancellor of the Exchequer, in answering Mr. Gray's question on ether for manufacturing purposes, said: 'Section 8 of the Finance Act of 1902 appears to cover such cases as the hon. Member has in view. Manufacturers desiring to be allowed the benefit of that section should address an application to the Board of Inland Revenue by whom it will be carefully considered.' We therefore beg to make the following statement:—We lately received an inquiry from the War Office for 10,000 pounds of smokeless blank manœuvre powder. The price offered was 3s. 6d. per pound—£1,750 for 10,000 pounds; with the proviso that the powder was to be made in England at our Chilworth Factory. We went into the question of cost, and we found that to manufacture this quantity we should require:—

lbs.	——	Cost price to us.	Duty on same.	Total
		£ s. d.	£ s. d.	£ s. d.
10,000	Nitro-cellulose at 1s. per lb. - - - -	500 0 0	Nil.	500 0 0
24,000	Pure ether (·720), at 3s. 6d per lb. - - -	4,200 0 0	2,300 0 0	6,500 0 0
6,170	Pure spirit, 74 over proof, at 7½d. per lb. - -	190 0 0	33 15 0	223 15 0
				£7,223 15 0

And other ingredients not dutiable."

2310. (*Chairman.*) I do not quite follow that?—These prices were figures given to me by a manufacturer.

2311. Does the 3s. 6d. per pound on the ether include the duty?—I do not think so, but we will leave out the dpty for the moment, and that makes it £4,200.

2312. (*Mr. Tyrer.*) Probably that 3s. 6d. should be 5s. 6d.?—Then it would be more than £4,200. Any way the value of the order was £1,750, and one of the items alone would have cost over £4,000; so that shows at once the impossibility of our being able to produce such a powder at any profit whatever.

2313. (*Chairman.*) That is assuming that you must have ether made from duty-paid spirit?—Yes

Pure ether regarded as essential to stability of the powder. (*See* also Qs. 2328-9).

2314. But is it absolutely certain that ether made from methylated spirit, which you can get very much cheaper, would not answer the purpose?—Our chemists informed us that they would not guarantee the stability of the powder, unless it was made with the pure spirit.

2315. Even the ether?—Even the ether.

2316. I can understand that the methylated alcohol might be open to objections, but I cannot understand the objection to the ether in this instance?—I think I have some evidence later on to give upon that.

2317. (*Mr. Scott-Montagu.*) What price did you pay?—They were asking us 3s. 6d. per pound for pure ether without the duty.

2318. (*Chairman.*) There must be some error in those figures, because if that is without the duty, then your column of duty ought to be a great deal more than it is. I wanted to know what attitude the War Office had taken towards this question, and I happen to have their correspondence here. I see that at that time you did not put the effect of the duty at anything like these figures. Writing to the War Office on the 4th April, 1904, you made out that if you used duty-paid ether and alcohol you would lose £700. That is a different figure from £5,000 or £6,000?—I have been trying to look up that back correspondence, and I cannot find it. I was not sure of my figures then, and it was between then and the time that I wrote my second letter that I saw the manufacturer on the subject, and he gave me these figures. Apparently I am wrong about these figures, and therefore I should like to take it in a more general way.

2319. (*Mr. Tyrer.*) Suppose you call that 11d., what difference does it make?—£1,100.

2320. That helps you?—Considerably.

2321. Under the provisions of the Act as to special supervision and a special denaturant, if a denaturant that would be at all suitable were permissible, you would be able to do it even then?—That is one item, but then there are others. The nitro-cellulose, for instance, is 1s. per pound—that is £500.

2322. (*Sir William Crookes.*) You are assuming that the alcohol and the ether which you use as a solvent is all wasted, but a great deal of it can be recovered, can it not?—That is so; but unless you have a continuity of orders it would be a costly matter to arrange for the recovery.

Certainly, you could store it, but I am not chemist enough to know whether stored ether and alcohol would be of the same value; I suppose they would.

2323. (*Mr. Scott-Montagu.*) You would not suggest that in making an ordinary smokeless powder anything like that cost was requisite, would you?—No; this was a very special one.

2324. Did they stipulate in the specification for that ether?—Absolutely pure—*schwefel-ether*, they called it—sulphuric ether.

2325. (*Chairman.*) You were to provide a powder that was in all respects the same as a powder that you had got from Germany before; was not that the order?—Yes.

2326. And then you took the specification from the German specification?—Precisely.

2327. You did not make any experiments yourself to determine, for instance, whether a less pure ether would suffice?—No.

Ether from methylated spirit not considered suitable.

2328. The ether is the expensive article?—Yes. We raised the point very strongly indeed, as to whether we could not use the ordinary ether of methylated alcohol, and they wrote back and said no, it was absolutely essential for the stability of the powder that it should be made of the very purest solvents it is possible to get. It seems to me that you do not really find out the effect of whether a pure solvent has been used until some considerable time after the powder has been made; it is a process of gradual—I was going to use the word evolution—but perhaps decomposition would be better.

2329. (*Mr. Scott-Montagu.*) Gradual change?—Yes, gradual change. I do not think that merely an examination of the oily feel, the smell, and so on, would give you an indication as to whether it was going to affect the stability of the powder.

Finance Act, 1902, in part the result of action by the Chilworth Company through the Explosives' Committee.

2330. (*Chairman.*) I do not want to make too much of that instance, but from the year 1902 it would have been possible for the Chilworth Company to have come to the Board of Inland Revenue, and to have said that they required for the purposes of their manufacture or of part of their manufacture to use absolutely pure alcohol. As a matter of fact they never did so apply until this incident occurred in May of last year; is that not so?—The question was raised some considerable time ago when I was not with the Chilworth Company. It was thought quite possible that a nitro-cellulose powder would be introduced into the British Service, and efforts were then made by the Chilworth Company to secure the use of duty-free alcohol.

2331. What date was that?—I have not got the date, but I believe it is referred to in the Report of the Explosives Committee for the year 1902. The question was raised on the Explosives Committee by the Chilworth Company saying that they would like to anticipate events by putting up a plant for nitro-cellulose powder which they thought was going to come in, and in the event of their doing so would the War Office help them to obtain concessions with regard to the use of duty-free alcohol? That is really what started the Explosives Committee on it. Then, as Secretary of the Explosives Committee, I pointed out that we could not ask the Board of Inland Revenue to make exceptions in favour of powder makers alone, and that our recommendation must apply to trade of all kinds in England, and on that Mr. Haldane then took action. But the Chilworth Company started it, so far as the Explosives Committee were concerned.

Need for duty-free alcohol not severely felt till 1904, when a demand for nitro-cellulose powders arose.

2332. That brings me to the point I want to come to, which is this: Section 8 of the Act of 1902 brought it within the bounds of possibility for the Chilworth Company to manufacture with pure alcohol; but, so far as I am aware, until this application in May, 1904, which was nearly two years after the Act passed, no representation whatever was made by the Chilworth Company or any other powder manufacturing company on the subject?—I think I can explain that. The Chilworth Company made their first application in 1902, because they wanted to get the plant ready in order to anticipate events. The nitro-cellulose powder was finally not taken up by the Government, and modified cordite was brought in instead. That stopped the Chilworth Company going on with the manufacture of nitro-cellulose powder, and with experiments on a manufacturing scale with such a powder, in their own factory. They have never had any inquiries of this nature until this question of the manœuvre powder cropped up. So that there was a big blank between their first application and their second one. Ever since then, we have had constant inquiries, caused by the war, for nitro-cellulose powders.

2333. That does establish this fact—that the need for pure duty-free alcohol was practically not felt by the manufacturers of powder during the two years 1902–4?—No, they did not feel it very much. But I was not in the Chilworth Company at the beginning of that time, and therefore I should not like to say that positively, as I did not join them till later.

2334. Parliament having legislated for the purpose of enabling powder manufacturers or other people, if they chose, and if the need was urgent, to use pure alcohol, I think we may assume that application would have been made to us if necessary; and the fact that there was no application does seem to suggest that the need at that time was not urgent—I do not say what it is now or what it may be in the future, but as regards the past, and taking the immediate past, for I suppose we need not go very much further back because these powders are comparatively modern inventions?—That is so.

Lack of initiative in English powder manufacturers attributed indirectly to high price of alcohol.

2335. Therefore, it is not necessary to go very far into the past, and therefore we may say that until the present year, 1904, there has not been any urgent need for permission to use pure alcohol in the manufacture of powder?—I think the reason of that is as follows:—Powder makers in this country have not got big experimental establishments of their own where they can investigate powders, and they have been content to follow rather than to take the lead. The Germans, on the other hand, are always trying to get their noses in front. They have a very large experimental establishment called the *Centralstelle*. They spend an enormous sum of money on the *Centralstelle*. There are certain powder companies grouped together, and they subscribe to it, and it does most excellent work for them. There has been practically no such initiative here. Cordite was brought out, and the English powder manufacturers were content to take what was offered to them in the way of carrying out orders from the Government, and they did not carry out any research work on a great scale like the Germans have done. That is the reason why I think so far in England the question of nitro-cellulose has not cropped up more than it has.

2336. That is quite a different reason from the particular reason or possible reason that the Committee have been investigating, namely, the difficulties in respect of alcohol?—Do you not think it re-acts in some way in it? Owing to the high price of alcohol in this country, investigation on a manufacturing scale is a very expensive thing which firms can hardly afford to enter upon.

2337. That is quite possible and conceivable certainly, but I do not know whether the firms themselves allege that?—Of course, I am not speaking for other firms, and I do not know what their views in the matter are. But it is my general opinion as a past secretary of the Explosives Committee and as the present technical manager of the Chilworth Company that experimental work in nitro-cellulose powders, which in my opinion is the powder of the future, has been thrown back in this country owing to the high price of the raw materials with which they should have experimented.

2338. The effect has been an indirect effect and not a direct effect; that is to say, its influence has been indirect by discouraging experimental operations rather than by discouraging actual manufacture?—Yes; and you must remember also that it is not the smallest use making a powder on a laboratory scale. If you want to find out whether the powder is good, you must use it in large units on a large manufacturing scale. That is what makes it so expensive. It is easy enough in the laboratory to make small amounts. I know when I first started the idea of the experimental establishment at Woolwich—and Dr. Silberrad will bear me out in this—we determined that we must have a place where we could make it on a unit system, and on a large manufacturing unit scale. To carry out that you want a very big plant. The buildings of the experimental establishment at Woolwich, which were on a manufacturing scale there, were very expensive indeed, and I do not think any firms in England have been able to afford that.

Capt. T. G. Tulloch.

7 Dec. 1904.

2339. Is there any Government powder factory?—Yes, there is the Government powder factory at Waltham Abbey.

2340. The price of alcohol would have been nothing to them?—No. The experimental work has principally been carried out by various Explosives Committees which have succeeded one another. When the need for a change in powder has come up, an Explosives Committee has been appointed. Formerly, of course, nearly all their experimental work was done at the Royal Gunpowder Factory, but now the Explosives Committee have got their own experimental establishment.

Importance of alcohol question not realized by English powder manufacturers till now.

2341. That brings me to my final point, which is this, that after all the manufacturers have themselves to blame if they have not, at an earlier period than they did, brought this matter before the attention of the authorities. So far as I know, I do not think there is any record in Somerset House prior to the last year or two of any manufacturer of powder coming to us and saying, or going to the Chancellor of the Exchequer and saying, that the excise regulations and restrictions as regards alcohol are such that it is impossible to conduct this industry satisfactorily?—It should be remembered in that connection that it is not so very long since the black powder was superseded. Ordinary cordite took the place of the black powder, you will remember, and it was not until some years afterwards that the question of nitro-cellulose to replace cordite was ever brought up, in fact it is only within the last four years or so that the question of nitro-cellulose powder has received serious attention in England. It may have gone back a little further on the continent; and of course isolated instances of experiments by private individuals with regard to the use of gun-cotton as a propellant have been made for a very long time past.

2342. In justice to my own Department, and even to the Government as a whole, I wanted to establish what I think we have now established, that the people who are really interested in this industry did not themselves sufficiently realise the hindrances which they now allege were put in their way by the duties on alcohol, and therefore did not make an application in the proper quarter; that is true, is it not?—Yes, I think that is perfectly true. The reason of it is, as I said before, that they have really contented themselves with following instead of striking out new lines. Whether that want of initiative was due to the knowledge that alcohol was so dear in this country or not, I do not know. So far as we were concerned, as soon as ever we began to feel the shoe pinching we promptly made application for some facilities under which to manufacture.

Regulations as to use of alcohol in Germany for making nitro-cellulose powders

2343. (*Dr. Thorpe.*) Are you aware whether any private concerns manufacturing this same class of powder, the nitro-cellulose powders, are allowed to use, and only do use, pure alcohol?—Yes, that is so.

2344. You know of no private factory in which the alcohol is denatured?—No, I do not.

2345. You are not aware, for example, that bone oil is required to be added to alcohol for the manufacture of these smokeless powders?—Might I read in reply to that the last paragraph of a note which I have in my hand: "The spirits used for the manufacture of ether is rendered impotable by the authorities by means of 0·025 per cent. of animal oil."

2346. That refers to alcohol for the manufacture of ether?—Yes.

2347. I refer to the alcohol which is used in association with the ether—not that from which the ether is derived, but which has subsequently to be used in association with it. Is that alcohol absolutely devoid of any animal oil?—I have a translation of a memorandum here on the Government supervision of alcohol at the powder factory at Rottweil—the memorandum, in fact, from which I have just quoted. The Rottweil powder factory manufactures only nitro-cellulose powder.

The Rottweil factory.

2348. Does it do that for private consumption?—It manufactures this powder for private consumption, as well as for German Government consumption. This memorandum, which I received from the Rottweil factory, reads as follows:—"Formerly Inland Revenue officials used to be at the Rottweil factory, but this permanent supervision through officials has now been done away with. The official supervision now takes place in the following manner:—The spirit arrives in sealed tank cars. The seals are put on the at place of dispatch by the Inland Revenue authorities who certify the quantity and strength of the spirit on a so-called 'dispatch sheet.' By means of this dispatch sheet we"—that is the staff of the Rottweil powder factory—"inform the Inland Revenue people of this town of the arrival of the alcohol, and the Inland Revenue fix a date of delivery. The authorities then see whether the seals are intact, ascertain the weight of the full tank car on the weighbridge in accordance with the railway regulations, and the strength of the spirit by taking three samples at different depths. The spirit is then pumped by means of an electrically-driven pump from the tank car through pipes into the spirit storage tanks. The latter are gauged by the authorities and graduated so that the contents can be read off. When all the spirit has been pumped into the storage tanks, the empty tank car is again weighed on the weighbridge, and from the weight of the spirit and its strength the quantity in litres of pure alcohol is ascertained. The latter quantity is used for Inland Revenue purposes, and not the quantity read off the graduation on the spirit storage tank. These two quantities never agree. The quantity of pure alcohol thus ascertained is entered by the Government official into a book which is kept at our office. In this book we enter in kilogrammes the quantity of spirit issued for the manufacture of powder, and for what purpose it is used. These entries have each time to be certified by an authorised factory official who is responsible for it. Every month stock is taken and the total of the quantities entered by us as issued is deducted from the quantity previously in stock. The quantity thus ascertained is then checked with the actual stock. There occur always small discrepancies which, however, are not objected to, so long as they are within tolerable limits. The spirit issued by us from stock has to be entered by us into our journal each time (in kilogrammes). At the same time the quantity has to be shown in the powder book as used. At the end of every month both books are compared by the authorities with the above mentioned book. After the stock has been taken and the two books compared by the authorities, the latter supply a new book, whilst the old book is sent to the Inland Revenue Office for subsequent control. The spirit used for powder making is not methylated, and is stored by us in its pure condition. We are liable to control visits from the revenue officers at any time. The spirit used for the manufacture of ether is treated in a similar manner, with the exception that the spirit used is entered into a control book which is balanced every quarter. Stock taking likewise only takes place quarterly. The quantity of spirit is in this instance not expressed in kilogrammes, but in litres. This spirit is also entered into our journal. Moreover a special book has to be kept in which all the quantities of spirit issued daily are entered. In another book the quantity of ether manufactured daily and issued to the factory has to be entered, and in the official control book we have to refer to this ether book. The spirit used for the manufacture of ether is rendered impotable by the authorities by means of 0·025 per cent. of animal oil."

Spirit used pure for the powder.

For making ether it is denatured with animal oil.

2349. We gather from that, that as regards the alcohol, no denaturant of any kind is added it to?—No denaturant of any kind whatever is used.

2350. But in the case of the ether manufacturer that alcohol is denatured with a certain amount of animal oil?—Yes.

2351. (*Mr. Tyrer.*) May I ask why it should be necessary to use a denatured spirit for the manufacture of ether and not have some degree of denaturing material in the alcohol itself?—That, I am afraid, I cannot answer.

2352. (*Dr. Thorpe.*) The animal oil is added to the alcohol prior to its manufacture into ether in the interests of safe custody, I presume—that is why it is rendered non-potable?—I presume so.

2353. I do not quite understand why it is that they should not also be required in the interests of safe custody to denature the alcohol required for use in powder although it is used in a relatively smaller quantity than the ether?—That I am afraid I cannot answer.

2354. (*Mr. Tyrer.*) Would not any other denaturant, but a denaturant of a very different character to methyl, and certainly a less offensive and possibly less injurious agent than animal oil, do?—I am afraid I cannot answer.

Price of alcohol in United Kingdom and Germany. Prohibitive effect on English competition of a difference of 6d. a gallon.

2355. (*Chairman.*) You have referred to the greater cheapness of alcohol in Germany as compared with its price in England, irrespective of duty, and you suggest that the excise regulations in regard to the production of alcohol are such as to make the alcohol much more expensive in this country than it is in Germany?—Yes, I do.

2356. You say that there are also other reasons why alcohol in Germany is at times cheap; for instance the fact that they encourage the production of it in a way that we have not done in this country and not are likely to do?—Of course you know more about that than I do, because you have studied the question a great deal more than I have.

2357. Let us assume that the cheapest English alcohol that you could get would be, say, 6d. per gallon more than the cheapest alcohol obtainable, not by you in Germany, but by your German competitor; would that make a very serious difference as regards the chance of getting orders from abroad?—It would make a tremendous difference.

2358. I take quite a vague figure of a possible difference of 6d. between the price at which a manufacturer in England can obtain his alcohol duty free, and the price at which the German manufacturer at Rottweil can obtain his. Assuming the difference to be 6d., and that there was a large order for powder from a foreign government, would that difference in price be decisive against you?—Yes. I will try to give you exact figures. For 10,000 lbs. of powder you might want 24,000 lbs. of ether and about 6,000 lbs. of alcohol. Suppose you recover in both countries the same amount, you merely put that in on the first cost, of course, There will be 6d. more on the 6,000 lbs. of the spirit, and I do not know what about the difference on the ether.

2359. I think that roughly the 24,000 lbs. of ether would represent between 5,500 and 6,000 gallons of alcohol. Taking the figures you gave us in your letter of May, you would really use somewhere between 12,000 and 13,000 gallons of alcohol, treating it all as alcohol, that is to say, converting your ether into alcohol; and that, at 6d. per gallon, would mean a difference of £300 on the 10,000 lbs. of powder?—But the ether costs us considerably more than the alcohol does.

2360. That is true; but the 6d. per gallon on the alcohol would be reflected in the ether, would it not? I think if you convert your ether into alcohol, and then take my difference of 6d. per gallon on the alcohol, it ought to about come out, ought it not?—Yes, taking it at that, the difference would roughly come out to about £300 in producing 10,000 lbs.

2361. That would add three-fifths of a shilling to the price; in other words, it would add 7d. per lb. to your finished article?—That is absolutely prohibitive. If you take an order at 3s. 6d., which is an average price, and put an extra 7d. on to it, that would absolutely throw us out of the competition altogether.

2362. You are satisfied, are you, that those figures are not excessive for the amount of ether and spirit combined that you would have to use for 10,000 lbs. of powder?—That is the specification on which we worked; those are actual figures. I am very sorry that they are not quite as they should be, but I did the best I could in collecting them from different sources.

2363. How much would you recover out of that?—I dare say you would recover perhaps 90 per cent.

2364. That makes a great difference?—The others are just as well off; the Germans would also recover.

Recovery of spirit.

2365. Yes, but then instead of applying the 12,000 gallons you should only apply to that 10,000lbs. of powder, 90 per cent. of the 12,000 gallons?—I beg your pardon. I should say 90 per cent. of the powder as it goes into the drying house, which is a different thing altogether, because you lose such a lot in your incorporators and in the other processes of the manufacture before it goes into the drying house. You may have lost 60 per cent. of your solvent before it goes to the drying house, and that would only leave 40 per cent. in. 90 per cent. is rather high, so call it 80 per cent, and that means 80 per cent. of the 40 per cent., which brings it down considerably. Until you get it into the drying house you cannot recover it.

2366. Looking at it from the other side, do you consider that the Chilworth factory might have advantages over, say, a German competitor in other respects, apart from the alcohol—advantages of a kind which would enable you to compete successfully against your German competitor, notwithstanding the fact that he had a moderate advantage in respect of the alcohol?—The question of wages comes in there, to a very small extent though. They pay in the Hamburg district an average of 23s., but of course the specialists, the skilled labourers, get more. I think we are paying about the same, so I do not think there is very much difference on the score of labour. I think you may say generally that it would turn on the question of the price of the raw materials.

2367-71. And that anything like a difference of 6d. per gallon on the particular raw material called alcohol, would be quite fatal to you?—As it works out, it would be quite out of the question for us. You see it will be a difference of 7d.

Sporting powders not adaptable for military purposes.

2372. (*Mr. Scott-Montagu.*) At Chilworth do you make other powders beside Government powders?—Yes.

2373. In the manufacture of those, which are not all nitro-cellulose powders of course, do you make a lesser nitrated powder?—We make now practically no powders in which ether-alcohol is used.

2374. Do you make what are called sporting powders?—We have practically given them up; we used to make them.

2375. Then perhaps you have not considered the possibility of adapting the sporting powder, which does not require so much alcohol or ether, for military purposes?—That has been considered. The great difference between a sporting powder and a military powder is that you want a sporting powder to bulk large, and the consequence is you do not want to colloid it; whereas with a military powder you want to suit it to different guns; and consequently you must have it under control as regards its rate of burning, and you can only control the rate of burning by having a colloid powder, that is to say, a powder which is not porous. Nearly all sporting powders, with the exception of ballistite, and one or two others, are made so as to bulk as large as possible and fill the cartridge case.

Alcohol for drying and hardening powder,

2376. I am going to put a question now from the point of view of having heard evidence which has been given by Mr. Griffith, of the Schultze Company: Would you use alcohol for drying and hardening as well as for a solvent?—Yes.

and for displacing water.

2377. Alcohol is really used in three processes, for the purposes of drying, in order to carry off the water, and also for hardening the grain?—That is so. There is another process which is a very important one, and that is the use of alcohol to drive off water from the nitrated cellulose.

2378. From the nitrated grain?—From the nitro-cellulose, for the purposes of safety.

Greater safety of the alcohol displacement process.

2379. I was coming to that point. As a matter of fact, besides making a better article, as you have conceded, you would avoid a great danger in the process of manufacture if you were allowed to use alcohol, because then you would not be obliged to use so high a temperature for drying your more or less finished product?—That is so.

2380. Therefore the avoidance of risk is another very strong point that you would like to put forward?—Yes.

Future of nitro-cellulose powders.

2381. Do you consider that the future of powder-making, from a military point of view, lies in the nitro-cellulose direction?—I do. I think that the powder of the future will be a nitro-cellulose powder, when we get to know more about it, or a nitro-glycerine powder with a large percentage of lower nitrated cellulose—that is, soluble nitro-cellulose.

Recovery of spirit more difficult with military than sporting powders.

2382. Therefore, if its production is to be commercially profitable, that is, if you are to produce a powder at a reasonable cost, you must recover in any case a very large proportion of the ethers and the alcohols used?—Yes.

2383. Therefore a recovery of only one-third would probably be insufficient to make it a commercial success?—Yes.

2384. You are probably aware that in the manufacture of sporting powder at the present moment the recovery is as high sometimes as 80 per cent.?—Yes.

Capt. T. G. Tulloch.
7 Dec. 1904.

2385. Do you consider that any recovery of that kind could be made of the ethers and the alcohol used in making nitro-cellulose powders?—I think it would be a very difficult matter indeed, without going to very great expense, to recover that percentage with military powders.

Pure spirit regarded as essential.

2386. There would be no possibility of your using a denatured alcohol in any of these processes, do you say?—I am afraid we are getting into the chemical side now.

2387. I will put it in another way. Supposing, for the sake of argument, that the Government will give you certain other facilities, would there be any objection to denaturing in the factory itself; I do not say that methyl alcohol alone should be the denaturant, but would it be possible to have the denaturing done in the factory under your own supervision, and then to use it for the purposes of your manufacture of military powders?—No; I think it is absolutely necessary that we should have the purest solvents possible.

2388. You do not want any denaturant at all then?—No, we do not. Our German friends advised us that denatured solvents, either ether or alcohol, are absolutely fatal to the stability of a powder, in their opinion; and they have carried out very long researches.

Question of price.

2389. You are aware, of course, that you could not hope under present circumstances to get alcohol in England as cheap as in Germany, even were you allowed to use duty-free alcohol, because you know there is a surtax of 5d., and in addition to that there are certain restrictions which English manufacturers labour under which their German competitors do not?—That is so, I believe.

2390. Therefore it would entail a very large alteration if you were to obtain alcohol to be used on a large scale as cheap as it can be obtained in Germany?—Yes, I am afraid it would mean a very large alteration in the law.

Prevention of dust and consequent risk of explosion by use of alcohol for displacing water (*See* also Q. 2398–2407.

2391. (*Sir William Crookes.*) There is another advantage of using pure alcohol which I do not think you have mentioned, or have only slightly touched upon, I mean in connection with the wet method?—Yes.

2392. Its use there prevents the chance of the dust of nitro-cellulose rising, which is a very frequent source of explosions, is it not?—Yes. I might perhaps enlarge upon that, as it will not take a second. In transit, it is, I will not say absolutely necessary, but it is very desirable to have your nitro-cellulose saturated with water, and in order to get out that water the best method is to use the alcohol method of drying. It is an expensive method, and with the present price of alcohol in this country, and so forth, it is almost impossible. But it is a very strong factor, so far as safety is concerned, that alcohol should be used to dry this powder. If you do not use the wet method, then you get a tremendous lot of dust from your paste, and also from the guncotton.

Use of alcohol in making cordite.

2393. There is a little further point which I want to touch. Up to the present you have been speaking about the use of alcohol for making nitro-cellulose powders, which you believe is to be the powder of the future. But in the immediate future cordite M. D. is likely, in England at all events, and a good many other places, to be enormously used. To use alcohol in making cordite is very important, provided we use this wet alcohol process of drying the nitro-cellulose; so the use of duty-free alcohol is not only required for nitro-cellulose powders, but also for the cordites?—Yes, that is so.

Little difficulty in protecting the Revenue from misuse of pure duty-free spirit.

2394. (*Mr. Nicholson.*) Having regard to the high rate of the duty, do you see any difficulty in protecting the revenue, supposing you were allowed to use this alcohol duty free?—No, I do not see any difficulty whatever. I think if you were to put it in responsible hands and issue your permission to respectable and responsible firms and throw the onus of responsibility upon them, that there would not be the smallest difficulty about it. It would be to their interests to keep on good terms naturally with the authorities, and they would take very good steps to see that the alcohol is not misused. My own opinion is that if a man wants to get drunk he will drink methylated spirits, but the instances of a man getting drunk would be so isolated that it would be a question of the loss to the revenue of a few pence almost, compared with the innumerable benefits that will accrue from the use of duty-free alcohol.

2395. It is not a question of getting drunk exactly, but it is a question of whether a man can abstract the spirit, and of a danger coming to the revenue in that form, as well as in the form of a man actually drinking it. Would a man be able to abstract the spirit?—No. The regulations governing the workmen in powder factories are so strict that I do not anticipate any difficulty whatever in a full and secure supervision being exercised over the workmen—in fact, in no other class of manufacture is closer supervision exercised than in a powder factory. When the men enter the factory they are searched and they change their boots and outer clothing for specially kept danger clothing, and when they leave the factory they change back again. They are searched on both occasions, both coming in and going out. Then as regards the issue of the spirit, the spirit would be kept in locked tanks, I should presume, and it would be issued under the superintendence of responsible foremen and taken direct to the incorporator, where once it is put over the mass it naturally could not be extracted for the purposes of drinking. The foremen are always in attendance, and I do not see how it would be possible without the connivance of people in responsible positions for a man to get any of the spirit which he could drink.

Partially denatured spirit for explosives in Germany.

2396. (*Dr. Thorpe.*) In the German returns there is a certain quantity of partially denatured alcohol returned in connection with the manufacture of explosives. I find, for example, that in 1903 there were some 36,322 bulk gallons of alcohol partially denatured for the manufacture of explosives. What character of explosives would they be if they are not things of the order you have mentioned?—I can only think that those figures refer to what I mentioned just now, namely, that the spirit used for manufacturing ether is rendered impotable by means of the addition of animal oil. Is it not possible that it may refer to that?

2397. No, because ether is given in a separate category, and I find that the amount of partially denatured alcohol used for the manufacture of ether in Germany was 1,135,398 gallons in 1903?—I am afraid I am not able to give you any information on this point then.

Alcohol for displacing water. (*See* Qs. 2377–80, 2391–2.)

2398. You have said something about the alcohol which is used for displacing water; have any experiments been made to ascertain how far methylated spirit can be used for that water displacement?—I do not know. The alcohol that is left in the nitro-cellulose in the receivers and the drying plant is accounted as a portion of the percentage of the solvent left in the incorporator. Therefore I presume that would be pure.

Pure alcohol considered essential.

2399. Let us be quite clear. You have got your guncotton saturated with water, and you say you cannot dry that in the ordinary way for two reasons—first, because you would have to raise its temperature, which in itself would be a somewhat dangerous operation, and then secondly because it would become dusty; is that not so?—Yes.

2400. Is that effect of raising the temperature and the formation of dust detrimental to you?—Yes.

2401. Therefore, in order to avoid the rise of temperature and the formation of dust in that way, you displace the water by means of alcohol?—Yes.

2402. You in fact pour alcohol over it so as to press out the water and replace it with alcohol?—That is not quite our method. There are two vertical tanks, and in one is put the charge of wet nitro-cellulose.

2403. That is, water-wet?—Yes; and in the other is the alcohol receiver, as it were. A pipe goes from the bottom of the alcohol receiver on to the top of the chamber containing the wet nitro-cellulose. There is a ram which exercises pressure on the alcohol in the receiver and forces it down on to the top of the nitro-cellulose. There is a tap at the bottom which is open, and gradually the water gets forced out until finally what comes through is alcohol, and then you may be certain all the water is out of it.

2404. In other words, that you have actually displaced the water by means of the alcohol?—Yes.

2405. I want to know if you can tell me why methylated spirit cannot do for that water displacement?—The bottom of the receiver is hinged and comes down like that (*explaining*). The whole of the nitro-cellulose saturated with alcohol is dropped into a metal receiver, and the lid is screwed on very rapidly so that none of the alcohol escapes. The alcohol that has been used to drive out

the water is also used as a solvent when the ether is added to it, and the consequence is that it is stuff which you want to have particularly pure. Therefore I presume that you could not use methylated alcohol.

2406. Inasmuch as that alcohol which you use to displace the water is retained in the material and is subsequently treated in the ether, your contention is that that alcohol must of course be pure ?—That is so.

2407. That damp alcohol-moistened material is never treated in any other way, is it ? Do you say it is dropped at once into the alcohol mixture ; is it never centrifuged or treated in any other way ?—No, it goes straight to the incorporator then.

Capt. T. G. Tulloch.

7 Dec. 1904.

2408. As regards the general question you have no positive experimental evidence as to the inimical effect of methyl alcohol ?—Yes. Major Nathan carried out some experiments for the Explosives Committee specially with that idea, and he reported that pure methyl alcohol is detrimental.

Methyl alcohol—Its effect on powders. (*See also* Qs. 2525-7.)

Dr. OSWALD SILBERRAD, called ; and Examined.

2409. (*Sir William Crookes.*) You have had considerable experience in the manufacture of explosives, have you not ?—Yes.

2410. You are the superintendent of chemical research under the Explosives Committee of the War Office ?—Yes.

2411. And have superintended work on a very large scale at the laboratory of the Explosives Committee ?—Yes, I think I may say so.

2412. You have travelled in Germany a good deal on matters connected with the Explosives Committee ?—Yes.

2413. And have seen the *Centralstelle* ?—Yes.

2414. You know Dr. Will of the *Centralstelle*, and in fact are in communication with the chemists there at the present time whenever there is any necessity ?—Yes.

Nitro-cellulose powders. Alcohol for displacing water, and as a gelatinizing agent.

2415. Pure alcohol is used there for several purposes ; will you explain what they are and what explosives they are used for ?—Pure alcohol is essentially necessary in the manufacture of explosives containing a large percentage of nitro-cellulose. The way in which it is used is principally as follows: Firstly to remove the water, as we have already seen, and secondly as the gelatinizing agent. Those are really the two principal uses as far as military powders are concerned. The question of hardening is rather a question applying to sporting powders. The objects of using alcohol in the question of drying are, firstly, because it removes the trouble of dust which is a great source of danger, as the sensitiveness of dry nitro-cellulose powder is bordering on to that of fulminate —it is indeed a very sensitive explosive. As a gelatinizing agent alcohol has certain advantages where the percentage of nitro-cellulose is high. For example, there is the question of brittleness which Captain Tulloch mentioned. Secondly, it is really a working impossibility to get rid of a solvent like acetone; but a mixture of ether and alcohol can be removed much more readily, because the ether seems to go off first and then leaves the alcohol behind, and the nitro-cellulose, being insoluble in the alcohol, no longer exists as a colloidal solution, so the vapour tension goes up at once and the alcohol is removed comparatively completely and rapidly; whereas the acetone remains in the state of colloidal solution the whole time, and it practically cannot be removed. Whether it is any real advantage to use alcohol in the manufacture of a powder containing a high percentage of nitro-glycerine, is a very questionable point. Personally, I do not think it is. From the point of view of safety, we can incorporate it under water—that is, we can mix the nitro-glycerine with the wet guncotton under water and then simply take that mixture and press the water out between rollers, and then do the final incorporation straight away with acetone, so that the use of dry guncotton can be overcome. Then, of course, in getting rid of the solvent, if there is a large percentage of nitro-glycerine present, that renders it quite easy to remove acetone. Therefore, in powders containing a high percentage of nitro-glycerine there is really no practical advantage to be gained by using ether-alcohol ; but it is a practical impossibility to make a powder containing a high percentage of nitro-cellulose or a pure nitro-cellulose powder without the use of ether-alcohol. As far as I know, every nation that makes these powders, with the one exception I fancy of Belgium, uses ether alcohol, and Belgium, I believe, uses amyl acetate.

2416. Under certain circumstances, would not pure alcohol be required in the manufacture of propellants, such as it is likely the English Government might adopt ? —Yes, that is possible.

2417. Therefore, this is not a question of using alcohol or allowing alcohol to be duty-free for the benefit of manufacturers who would manufacture for foreign countries, but it is also for the benefit of manufacturers who would manufacture for the English Government ?—Yes, for their possible benefit.

Dr. O. Silberrad.

7 Dec. 1904.

Government interest in the alcohol question.

2418. You have heard what has been said about methyl alcohol and methylated spirit, and about the Rottweil people saying that it is absolutely necessary for it to be perfectly pure ; I think you have had a great many experiments on that point ?—Yes ; a large number bearing on that point, although I cannot say that I have investigated the subject from the point of view of the use of methylated spirit, or indeed of any denatured spirit ; but rather in connection with researches on the stability of explosives, and on the effect of various additions on their stability.

Methylated spirit. What are the ingredients which make it unsuitable and affect the keeping qualities of the powder ?

2419. Would you tell us, as far as you can, the effect of the impurities and what the impurities are ?—Yes, firstly, if we do the drying by the displacement process with alcohol, any impurities insoluble in water will, of course, be precipitated as soon as the alcohol comes in contact with the nitro-cellulose. Then of course those will have to be washed out by using a larger excess of alcohol than would otherwise be used.

2420. (*Dr. Thorpe.*) May I intervene ? Is that a practical point ? I was coming to this point—that the question of the washing out of any impurity from nitro-cellulose is almost impossible ; it shows evidence of absorption to such an extent that it is quite impracticable to reduce the impurity by washing to any limit that would not affect the stability of the powder very seriously.

2421. May I point out that you are simply setting something up—a purely hypothetical thing—for the purpose of knocking it down ? There is nothing whatever of the nature of any material which has to be washed out in this particular way contained in methylated spirit ?—On the contrary.

2422. Then let me hear about it ?—In denaturing methylated spirit you would propose to use crude wood naphtha, would you not ?

Basic substances. (*See also* Qs. 2499-2506.)

2423. To use wood naphtha as it is defined by the regulations ?—There are traces of bases in that ; is that not so ?

2424. Yes. But what are they and what is their amount ?—I think you should be in a better position to tell the Committee than I. I carried on these investigations rather from the point of view of examining the stability of the powder and the effect of certain conditions on the stability of the powder than from the point of view of the use of solvents.

2425. I could tell you what the traces of bases are, but I think it is rather for you to tell the Committee what there is in methylated spirit as you know it to be, that is in any way adverse to its use for this purpose?—We will say bases. A mere trace of bases will set up aminolytic decomposition very distinctly in any nitro-cellulose propellant ; and, of course, that leads to the formation of nitric peroxide in quantity. That means internal oxidation, and since the nitro-cellulose must be regarded as a compound that is distinctly in an unstable state of equilibrium, the decomposition once started rapidly accelerates itself. It is one of the finest examples of a catalytic self-accelerating reaction that one can possibly have from an experimental point of view.

2426. May I then ask you about the bases which you have put in the forefront as those things which apparently

Dr. O. Silberrad.

7 Dec. 1904.

are likely to be disadvantageous?—I should say that those are one of the most troublesome chemical causes of the bad effect of ordinary methylated spirit.

2427. The basic materials, do you mean?—I should think so. Methylated spirit is most detrimental to powder.

2428. That is a mere affirmation. It is no use re-affirming; we want to know why?—You want to get to the back of it?

2429. Yes?—Precisely so. I maintain that it is the impurities in the methylated spirit that are the cause from a chemical point of view.

2430. That again is vague. I do not know what you mean by impurities, and I want to know what the things are. You have particularly mentioned the basic materials present in methlated spirit as being in your judgment among the most disadvantageous ingredients?—Yes.

2431. What are they?—I should refer to your Dictionary if I wanted to know them.

2432. I understood you came here to tell us all these matters?—What I say is this, that methylated spirit is bad, as it produces powders that will not keep. That is an experimental fact. You ask me why? I can only say that we have experimented on the effect of the addition of a very large series of compounds on nitro-celluloses as regards the keeping properties of them. Some of them are bad, and some of them are good. When you ask me what is the cause of the bad effect of methylated spirit, I would say that it is probably the impurities in the spirit. Then you ask me what the impurities are? It seems to me that your question deals with the analysis of methylated spirit rather than a knowledge of the facts respecting powders.

2433. Or the analysis of the wood naphtha. It is not in the alcohol?—No.

2434. Because you said, "If I am allowed to keep the wood naphtha out, I can get along with the alcohol."—Yes.

2435. So that we may exclude anything in the alcohol?—Yes.

2436. Therefore, we are solely concerned with the materials which are present in the one-tenth of volume of wood naphtha which is added.—Precisely.

2437. I want to know what they are?—With all due deference, it seems a curious question from the Principal of the Government Laboratory, does it not? I should think probably the basic materials are mainly at the root of the evil as far as that is due to chemical action.

2438. The basic materials?—Probably. I am not sure whether some of the unsaturated phenolic bodies might not possibly be included.

2439. It is your opinion that the basic materials are mainly at the root of what you allege to be the mischief?—I should say they are the principal cause of the very material evil of the impurities left behind by the methylated spirit. But I must qualify that by saying that that is not based on experiment. I worked with methylated spirit. The methylated spirit was bad and it produced a powder that would not keep—repeatedly I mean.

2440. You are a scientific man and you have gone to work at this thing in a scientific way?—Yes, but scarcely with the object of elucidating the cause of the effect of methylated spirit on powders; my knowledge on that is rather a by-product of other investigations.

2441. I presume that when you have got an effect you have tried to trace it to its cause?—Our experiment with methylated spirit was merely to see whether we could use it for big scale experiments instead of pure alcohol. I had no object then in ascertaining why methylated spirit was unsuitable. It was unsuitable, and I therefore wasted no more money in working on it, but utilised pure spirit.

2442. Again I press my question: I want to know what is it in the methylated spirit which prohibits its use, and you say the only probable element is the bases?—I should think that the chemical effect was probably due to the bases. That statement is based on the fact that we have experimented with all sorts of substances, and of all the substances likely to be present in methylated spirit we find that bases exercise a most detrimental chemical effect.

2443. Now then, what bases are they, and in what quantity are they there?—They would be there in the very smallest quantities, but then you only want the merest trace of them to initiate decomposition.

2444–5. In what quantities are they there, and what are they? In the first place, are they there as free bases?—I should think so probably, but I must candidly confess that my knowledge of methylated spirit cannot compare with yours. I have not specialised on methylated spirit.

2446. May I put my point of view to you? I am asked to advise the Board of Inland Revenue whether, under the conditions and the regulations, methylated spirit is unsuitable or detrimental in this manufacture. That is a question which is constantly put to me. I take all the pains I can to make inquiry into it, and I say, looking into the question of methylated spirit, and knowing what methylated spirit is, I can see nothing in methylated spirit which is unsuitable or detrimental—I do not say that in your particular case; I am speaking generally. I am asking you for information, as I should probably have to go to you or to somebody similar for information on this particular point. I ask you what it is in methylated spirit which is unsuitable or detrimental?—You say you know what is in methylated spirit. Would you mind enumerating its constituents? If you could do that, I could treat the thing then from the point of view of our scientific work. I worked with methylated spirit, as I say, to ascertain whether it could be used. It could not be used, and therefore I carried out no further experiments. You see experiments mean time and money, and we must not do more than we can help. We are not allowed to follow up a thing to its bitter end; there are far too many remunerative problems to be investigated.

Composition of wood naphtha.

2447. May I point out to you that by, the very evidence you have afforded us in your *précis*, you have practically excluded a very large number of substances which are in the wood naphtha, as not being in the least degree disadvantageous. Therefore, I have come down to certain very minute things which are in wood naphtha, and I am going to ask you whether those things, in the very small quantities in which they are there, can possibly be detrimental. For example, take an ordinary typical specimen of wood naphtha, such as is used for methylating purposes. The first thing, of course, is the methyl alcohol. Taking a hundred parts by volume there are in a typical specimen about seventy-five parts of methyl alcohol. You tell me in your *précis* that methyl alcohol as such—at least so I gather from what you say—has no effect upon the keeping quality of the material. You say, "Methyl alcohol, if quite pure, would not be detrimental, except in so far as it reduces the solvent power of the ether alcohol for nitro-cellulose"?—Yes, I think that is so. That is the result of my own experiments.

Methyl alcohol.

2448. That may be so, but of course I take it from you that it is so. Still that has nothing whatever to do with the keeping quality of the powder?—No; it is not likely to affect the keeping quality of the powder from a chemical point of view.

2449. (*Mr. Tyrer.*) That is, the methyl alcohol could not?—Yes. It is rather a question of its solvent properties that render it detrimental.

Acetone.

2450. (*Dr. Thorpe.*) Now we come to the next item which is present in a tolerably large proportion in wood naphtha. The next item in largest quantity is ordinary acetone, and you say with respect to the specific action of acetone that acetone "would lead to gelatinization during the displacement process and would thus interfere to some extent with this process"?—Yes, elsewhere I refer to the obstinate way in which it is retained by nitro-cellulose.

2451. There again, what is the effect of acetone upon the keeping character of the powder?—Upon the keeping character it would have no effect. May I deal with it under the other heads, namely its gelatinizing action and the obstinacy with which it is retained by nitro-cellulose?

2452. Yes; but at present I am only talking about why these things affect the keeping quality of the powder. We have got as far as this therefore, that 86 per cent. of what is in the wood naphtha exercises no hurtful or detrimental effect?—Yes.

2453. The next largest item that there is in wood naphtha is the water, of which there is in a typical specimen about 10 per cent. ?—Of course that would only affect the solvent property, and consequently the physical state of the powder.

2454. It would have no effect on the keeping character ?—It would have no direct effect on the keeping properties.

2455. I have got then to something like 96 per cent. of the wood naphtha ?—Yes.

Methyl-ethyl ketone.

2456. Now we come to the other things which are in next largest quantity in wood naphtha. There is another ketone which is present as a rule up to the extent of very nearly 1 per cent.—that is methyl-ethyl-ketone. Would methyl-ethyl-ketone behave any differently from ordinary dimethyl-ketone ?—I should say not. It certainly would not affect the keeping properties.

2457. Now I have got about 97 per cent. of the total ?—Yes.

Methyl acetate.

2458. The next thing is methyl acetate; what about methyl acetate ?—I just mentioned that at the end of my *précis* as a separate solvent. That would have no effect on the keeping properties, but it is a slight gelatinizing agent and would interfere in that way to a slight extent.

2459. Like acetone ?—Precisely; except that it would interfere only with the displacement process.

2460. But it would have no detrimental effect upon the keeping of this material.—No; that has been proved distinctly.

2461. The methyl acetate and the traces of higher acetates which are present in a typical wood naphtha are present to the extent of about 2 per cent., are they not ?—Yes, I believe so.

2462. Now I have got to account for all the other things; how much have I got then ?—You have 1 per cent. left.

2463. Then you have got 1 per cent. by which to account for this so-called detrimental action. The number of things which are present in that 1 per cent. is pretty numerous ?—I believe it is.

Higher ketones and acetals.

2464. But they are all bodies of exactly the same type as we have been talking about. For example they are the higher ketones, methyl-propyl-ketone, allyl-methyl-ketone, allyl-ethyl-ketone, and acetal—dimethyl acetal, methyl-ethyl-acetal, diethyl-acetal, and methyl-propyl-acetal—all of them perfectly neutral substances ?—Yes.

2465. The aggregate amount of those, so far as I can make out, is about two-tenths per cent. ?—Of course unsaturated bodies——

2466. The allyl compounds are, but that is all—the others are not ?—The allyl compounds form nitrosates and they possess an acid reaction, and start just the same decomposition, which is liable to lead to spontaneous ignition.

Minute quantites of unsaturated bodies enough to set up decomposition.

2467. They are all comprised in that two-tenths per cent. ?—Yes.

2468. It is the rarest possible thing for you to find any allyl alcohol, or any allyl alcohol derivative ?—Any unsaturated body which re-acts with nitric peroxide with the production of acid products is detrimental: a difficultly volatile aldehyde is harmful. As illustrative of the exceedingly small quantity required to initiate decomposition of this nature, let us consider a relatively non-volatile substance, such as dimethyl aniline for example. We wished to know the effect of that on powder, so we placed a dish of dimethyl aniline beside a dish of powder, covering them with a bell glass, and then we let them stand for periods amounting to perhaps four or five hours. The quantity absorbed I leave you to estimate. It certainly is very small. Yet, the effect was distinctly perceptible.

2469. I do not quite understand the relevance of that. Why dimethyl aniline ?—I merely took it as illustrative of the very small quantity required, and chose it because it is relatively a non-volatile substance, and a substance we had worked on. It gives off enough vapour to the powder to materially affect its keeping properties.

2470. Is that a fair analogy, because dimethyl aniline is a strong basic substance ?—It was not chosen as analogous, but as an example of the very minute quantity of a harmful substance necessary to initiate decomposition.

2471. The vapour tension of dimethyl aniline is fairly considerable, and on account of its high molecular weight you must know there is a quantity of it in the vapour ?—Possibly. When one comes to measure by weighing it is quite impossible to weigh on the most delicate balances the amount that is transferred to the powder. Yet that is sufficient to materially affect the keeping properties of the powder.

2472. It would be very much more relevant to our inquiry if you had taken things which are actually present in wood naphtha, and had not taken something which has nothing whatever to do with wood naphtha. Dimethyl aniline has nothing whatever to do with the point, has it ?—I have already endeavoured to make that point clear.

2473. If you had made these experiments with the basic materials which you know to be present in wood naphtha, then that would be a perfectly relevant observation; but to tell me you have made them with dimethyl-aniline, which has nothing whatever to do with anything that is in wood naphtha, is not germane to the point ?—I mentioned it to indicate the quantity that was necessary to start these decompositions.

2474. Yes, of this particular thing which may or may not be active. But I am concerned with the things that are in wood naphtha, not with something else. You might as well say you had taken prussic acid, or anything you like; it is not revelant to the point ?—Well, let us go back to the acetal. We have experimented with aldehydes in quantities amounting to from about 0·1 to 0·05 and even down to 0·01 per cent. Quantities of that nature present in the finished powder are sufficient to exercise a harmful effect.

Acetal.

2475. Is acetal included among the things you have mentioned in your *précis* ?—You have mentioned it as typical of one of the substances.

2476. Have you mentioned it ?—No, because I did not consider it likely to be put forward as a denaturing agent. I did not put it down in my *précis* because I was only selecting substances which had been recommended for denaturing agents. Possibly it might facilitate matters if I remind you that, as a Government iservant, I have absolutely no interest in this either way, and I have only wished to bring the facts before you.

2477. I have nothing to do for the moment with what other things might or might not be used; the real point I am addressing myself to is methylated spirit as it is ?—These aldehydes re-act, as of course you know, with nitric acid and nitric peroxide, and they form substances which are detrimental to the keeping properties of powders and are likely to start this decomposition. That is what we must avoid. You understand that it is a question of the merest trace. The decomposition only wants starting, and then it has an auto-catalytic action which accelerates itself.

Aldehyde.

2478. Have you ever taken ordinary alcohol, what you would call pure alcohol, and determined how much aldehyde there is present there ?—Yes.

2479. Well ?—It is small.

2480. Is it greater or less than there is in wood naphtha ?—It would be less, distinctly, than that introduced into the methylated spirit through the addition of wood naphtha.

2481. Less in alcohol ?—Probably less when you compare pure spirit with methylated spirit.

2482. Is there more aldehyde in wood naphtha than there is in fermentation alcohol ?—I should say there was more in ordinary fermentation alcohol.

2483. Yet you are going to use fermentation alcohol, and you do use it ?—Perhaps the way I have put this is not quite clear. The aldehyde we added was added to a finished powder and was in the finished powder. Now a substance that is in the finished powder cannot be got out easily. But I take it, when in solution, the more volatile things will come off first, leaving behind, of course, not acetal, because that would go when you use pure alcohol, but less volatile aldehydes present in wood naphtha which are not likely to be present in pure spirit.

2484. We are dealing with ordinary aldehyde, and you have just now said that one of the things you strongly

Dr. O. Silberrad.

7 Dec. 1904.

deprecated was aldehyde?—I said the aldehyde was detrimental to the powder if left in the powder.

2485. I come back, and I tell you that the very act of diluting—— ?—Would make it harmless? Doubtless it would reduce the effect, but I should be sorry to say it would make it harmless.

2486. There would be actually less aldehyde than there would in the ordinary spirit?—Possibly, in the case of ordinary aldehyde; and in this case I would add that diluting it with the other solvents would render it harmless, because it would be carried off and not left in the finished powder.

2487. What I mean is that the addition of the wood naphtha, *quâ* aldehyde, has no effect?—I do not really think it would, except in so far as the less volatile aldehydes were concerned.

2488. So we can dispose of that?—Unless possibly some of the higher aldehydes might be considered; but I should think they are present in too small a quantity.

2489. You have no knowledge that they are there?—No, I could not say they were.

Basic substances.

2490. Now I come down to these basic substances, for that is really the whole point, and as a matter of fact all the rest is purely hypothetical. We have come down now to these basic substances, have we not?—Yes.

2491. Have you ever attempted to form any idea as to what these basic substances are, and in what quantity they are present in methylated spirit?—No, I have never experimented on methylated spirit. From a scientific point of view one avoids mixtures as far as possible; but I conclude from experience gained in examining the effect of the addition of various pure substances to powders that bases are the most probable chemical sources of the trouble in using methylated spirit.

2492. Have you got any idea in your own mind as to what amount of basic substances there may be in wood naphtha—I am not speaking about methylated spirit now, but wood naphtha?—I should say the amount would be very small, because powder made with methylated spirit did not show aminolysis very rapidly. It was not a powder that one could keep or use; but it decomposed relatively slowly, so that, arguing from that, the quantity of basic substances must be small, because when we added small quantities of bases, even imponderable quantities of bases, aminolysis starts very rapidly.

2493. In this case it did not start, although when you added imponderable quantities it started rapidly?—Relatively, yes.

2494. In this particular case it took some time to start, and therefore the bases must have been even less than imponderable?—They are very small in amount, but they are sufficient; that is the point.

Aldehyde (furfural) and methylamine (*See also* Qs. 2527-8).

2495. Is there more or less in fermentation alcohol of furfural?—Furfural is not a base.

2496. It is an aldehyde, is it not?—Yes.

2497. Is there more or less of furfural and methylamine in fermentation alcohol than in wood naphtha?—Taking methylamine alone I think there is far more in wood naphtha; is that not so?

2498. Is it your impression that there is more methylamine in wood naphtha than there is in fermentation alcohol?—That certainly was my impression.

2499. Have you any idea how much there is?—I have already said it must be small from our experiments.

2500. Have you ever tried to see whether methylated spirit, or even wood naphtha, has got an alkaline reaction or an acid reaction? Has it ever occurred to you to place a piece of litmus paper in it, or to treat it with methyl orange and see what happens?—No, I have never worked with the substances; they have never come into my line at all. I should say that the reaction would be acid probably—that it would show traces of acetic, or something of that sort.

2501. Will you take it from me that all the wood naphtha which is used for methylating gives the very faintest acid reaction to litmus?—Yes.

2502. And an alkaline reaction to methyl orange?—Yes.

2503. So that it is practicllay an amphoteric substance?—Precisely.

2504. What amount of free base can there be in a liquid which gives such a reaction as that?—The base need not be free.

2505. But I asked you as to that and you said it was free?—I cannot recall that question. If methylamine is there, decomposition sets in from the action of the bases, yet directly it gets into the powder if forms a nitrate or a nitrite. Hence it obviously is of small moment whether it be free or in combination with acids.

2506. I asked you just now whether the bases were supposed to be free, or whether they were supposed to be combined, and you told me you thought they were free in the methylated spirit?—I cannot recall that question. I am rather regarding the whole subject from the light of its effects on a powder, in which case it is immaterial. Indeed, the whole question seems to me to be summed up in my first statement that methylated spirit produces a powder which has bad keeping qualities. With respect to methylated spirit, I can, of course, say what experiments we have done with those bodies present.

The view maintained that methylated spirit is deleterious to keeping qualities of powder.

2507. I have told you incidentally what is in methylated spirit?—Yes, you have, and I have endeavoured to tell you what we know about the substances mentioned. The fact still remains that powders will not keep when made with methylated spirit. The experiments that we have made on the individual substances show what effect each particular substance has on the powder, as far as we have experimented with it. Whether the list of substances with which we have experimented happens to be sufficient to clear up this question of methylated spirit or not is, of course, rather another matter.

2508. May I point out that you have practically not experimented upon the things which are in the substance which you assume is detrimental and injurious—you have not taken those substances and experimented with them—you have not taken the problem to pieces, so to speak?—No, we have not dealt with the matter systematically from the point of view of the application of methylated spirit.

2509. (*Chairman.*) I think we have now got to this point, which is interesting, but perhaps we ought not to go any further into it, that you are perfectly satisfied that powder made with methylated spirit has not the keeping properties of powder made with other spirit, but you have not got beyond the region of conjecture as to why that should be so?—Exactly.

2510. You have not carried out exhaustive experiments to enable you to do more than merely state the fact, without being able to state the reasons?—Yes, precisely so. It is simply as I say, that we tried methylated spirit to see whether we could use it instead of pure alcohol. We found that we could not, and therefore we used pure alcohol.

2511. (*Mr. Tyrer.*) That is what is called absolute alcohol?—Yes, absolute alcohol. We do not, of course, go on working out scientific reasons unless there is some object to be gained from the Government point of view, because the number of problems to be done in a place like the Chemical Research Department at Woolwich is far more than can be accomplished: also the money is very limited, and these experiments costly.

2512. (*Chairman.*) Are you absolutely satisfied that your experiments were sufficient to establish the fact that the powders were not stable? Have you no doubt about that?—It is a very big thing to say that one is absolutely certain. It would mean experiments on a very big scale and those experiments that I have referred to were not on a sufficiently large scale to place one in a position of absolute certainty. But personally I have no doubt whatever.

2513. Then even about the fact itself, without going now to the reasons for it, you do not feel absolutely certain?—The fact is that some twenty different samples, fairly large quantities, made by that method did not keep properly. They showed very inferior keeping qualities to the powders made with pure alcohol.

2514. In the manufacture of those twenty samples was the only difference the use of methylated spirit?—That was all. We used ·720 ether throughout.

2515. (*Mr. Scott-Montagu.*) I think you agree with a previous witness, Mr. Griffith, of the Schultze Company, which makes sporting powders, who said that although he, like you, could not absolutely account for the reasons, he had no doubt that methylated spirit is not quite suitable for the manufacture of powder?—I think one may safely say it is not suitable.

Suggestion of a special quality of wood naphtha as a denaturant.

2516. Have you tried to do what Mr. Griffith has done, which is to get specially pure methylated spirit, which presents less difficulties?—No, there would be no object in it. We buy pure alcohol, and, being a Government department, the duty is not a matter of great importance. Unless Government wanted to use a nitro-cellulose powder, I should not work any further in that direction.

2517. As a matter of fact, were you aware that a specially pure kind of methylated spirit can be used with less harmful results?—I know one used to be able to get a better methylated spirit for chemical work generally. Of course I have not troubled about these things in the Government laboratory, as the duty is not of much importance under such conditions; and in experimental work one is naturally desirous of eliminating any influence that may be disturbing.

2518. (*Dr. Thorpe.*) Do you say you know that formerly you could get a better methylated spirit than you can now?—No. There are, I believe, or used to be, two sorts of methylated spirit—one which they will sell to you for chemical work—and a second inferior quality which you get, for instance, at oil shops for burning. Was this not so?

2519. The sole difference is that what you get at the oil shop has added to it a very small quantity of petroleum otherwise it is the same methylated spirit?—But petroleum is rather a drawback for chemical work, is it not? I am speaking now of ordinary general chemical work.

2520. The point is the effect of the wood naphtha, and on being asked whether you could get a better quality of wood naphtha, you said that you were aware that formerly you got a better type of methylated spirit for working with than you can now?—No; I was not saying you got a better quality than now; you misunderstand me.

2521. (*Mr. Scott-Montagu.*) Would you agree with Mr. Griffith that, supposing you were called upon to do it, you could obtain a chemically purer methylated spirit, possibly free from certain deleterious ingredients?—I have heard it stated, but personally I have no experience.

2522. (*Sir William Crookes.*) What methylated spirit did you use for these experiments?—The ordinary methylated spirit.

2523. Was it spirit bought at the oil shop?—No, it was bought from Mr. Tyrer.

2524. (*Dr. Thorpe.*) Have you ever tried two sets of experiments, one with purified wood naphtha and the other with purified methylated spirit; that is to say, having digested it with caustic soda and so on?—No, I have never worked with materials purified in that way.

Methyl Alcohol. Its effect on powder.

2525. (*Sir William Crookes.*) We have heard of an experiment of Major Nathan in which he used methyl alcohol and ethyl alcohol and a mixture of the two, and as a result he said that when there was methyl alcohol used the powder was not so good. You seem to have come to the opposite conclusion, is that so?—From a chemical point of view it is difficult to see why it should not be as good. The effect is probably rather physical: it would reduce the solvent property of the ether-alcohol. Of course that would mean making the powder slightly more porous, and if it is slightly more porous it is a little more exposed to the hydrolytic effect of moisture in the air; and then if hydrolytic decomposition starts that means nitric acid, and then you get the same violently self-accelerating decomposition.

2526. Were you with us when Major Nathan made those experiments?—Yes, I think we had that report at Newcastle.

2527. He was very definite that it did interfere with the quality?—That may be due to a purely mechanical effect. Might I return to that question of furfural and aldehyde? I think there, again, it is a question of a misunderstanding. What I said was this: If aldehydes are present in the finished powder they are detrimental, but I pointed out that a small trace of aldehyde in the solvent first used is not likely to be left behind in the finished powder; so that whether the aldehyde is in methylated spirit or whether it is in pure spirit, I will not say pure spirit, but fermentation alcohol—providing it is of a fairly low boiling point, I do not think it would hurt the powder in the least.

Furfural and aldehyde. (*See also* Qs. 2495-8).

2528. (*Dr. Thorpe.*) I quite agree with you there. Therefore we may put aside the aldehydes, although you quoted them as having an adverse effect?—Surely some of them are fairly heavy, and they have an abominable way of polymerising on the very least provocation, as you know.

2529-32. This is all surmise. I am dealing with the absolute facts concerning methylated spirit and what I know wood naphtha contains?—The absolute fact, if I might say so, is that methylated spirit produces a powder with poor keeping qualities, as far as our experiments go.

Chemical industries: Their backward position in United Kingdom.

2533. (*Chairman.*) I see towards the end of your *précis* you make one or two remarks upon the cause of the decline of the chemical industries in this country. Do you consider that the chemical industries have positively declined, or that they have not advanced as much as they ought?—I think perhaps the latter is the better way to put it; we have hardly developed new industries as much as we might. I only know of a few cases where industries have actually declined. I know of one large firm, for instance, that used to manufacture a large amount of alkylated anilines and they have entirely dropped that manufacture now.

2534. What firm is that?—Messrs. Read, Holiday & Sons.

2535. But otherwise it is rather a case of not keeping pace with other countries?—That is my humble opinion.

2536. (*Dr. Thorpe.*) Why have Messrs. Read, Holiday & Sons dropped the manufacture of dimethyl aniline, which is so important an intermediate product in the manufacture of so large a group of colouring matters?—They told me that it was the question of the duty on methyl alcohol, purely and simply. They make enormous quantities of aniline and they make very large quantities of rosaniline—in fact they export a tremendous lot of rosaniline to Germany; but they make none of the methyl violets and they make no dimethyl aniline. The plant for dimethyl aniline I happened to see in a field lying idle.

2537. Were not Messrs. Read, Holiday & Sons aware of the fact that they could get methyl alcohol for the manufacture of dimethyl aniline without the payment of any duty?—I have only stated what they informed me.

2538. They were not aware of the fact that this Board has granted the use of methyl alcohol for the manufacture of dimethyl aniline as far back as 1897?—I presume they were not. That was the reason they gave me, and, as I say, the plant was lying there idle.

Causes assigned.

2539. (*Chairman.*) As regards the several causes, you give four in your *précis*, namely, (1) the duty on alcohol, (2) the scientific apathy of manufacturers, (3) the inefficiency of chemists (Education), and (4) the lack of an institution like the *Centralstelle*?—Yes.

2540. You place first the duty on alcohol; is that because you consider it as being first in importance?—I should not like to be a judge of its relative importance. It is too big a question.

2541. You do not attach any particular significance then to the order in which you have placed these four causes?—No, I place none. My own opinion is that the fourth cause—the lack of an institution like the *Centralstelle*—is the most important.

Dr. O. Silberrad.
7 Dec. 1904.

2542. What is the *Centralstelle* ?—It is a large institution for carrying on scientific technical investigations. It is supported partially by Government and partially by various firms; and the firms that assist in its support may submit any problems they like to be investigated.

2543. Is it in fact a technical school ?—Scarcely, the entire staff consists of paid assistants.

2544. (*Mr. Scott Montagu.*) Is it established mainly for research ?—Yes. Entirely for research.

2545. (*Dr. Thorpe.*) Since you put No. 4 as first, may we take it that all the rest are in the same inverted order, namely, that No. 3 comes next to No. 4, No. 2 comes next to No. 3, and No. 1, which is the duty on alcohol, is the least important of the four ?—I did not wish to convey anything by the order in which I have placed these four causes; the opinion I express is not based on any exhaustive comparative study of the question.

2546. (*Mr. Scott-Montagu.*) You mention in your *precis* a paper which you read before the Society of Chemical Industry; when was that read ?—It appears in the journal of the Society of Chemical Industry, published on the 30th June, 1902.

Synthetic perfumes. Limited production in this country attributed to cost of alcohol.

2547. (*Mr. Tyrer.*) I know that you have had some experience in synthetic perfumes and essential oils, so I should like to ask you whether you know that synthetic perfumes have been made in this country ?—Yes, they are made and sold to a certain extent; but the great difficulty, where methylated spirit is used, is to get off the smell of the methylated spirit. Of course, none of the products that we have considered to-day should leave any smell—you will agree with me will you not, Dr. Thorpe ? Yet the quantities present are still sufficient to be detrimental in this instance.

2548. (*Dr. Thorpe.*) Do you mean the guncotton ?—I mean none of those products in the methylated spirit which we have considered as making up the methylated spirit, even those known to be present in the most minute quanties, should leave any smell; but still, the fact remains that synthetic products of that nature, crystallised from methylated spirit, do smell, and it is a most extremely difficult thing to remove the traces of the odour and to get a product which will compete with those crystallised from pure alcohol.

2549. (*Mr. Tyrer.*) I did not wish to introduce the word crystallisation, and my question did not apply to that, but rather to this—that where ethyl or methyl enters into the molecular composition of synthetic perfumes, alcohol may be required; and, therefore, the methyl may give its flavour. Where either enters molecularly into these products of manufacture, are they made in this country to any extent or at all, in fact—I know that experiments have been made ?—As far as I know—and I have done a considerable amount of work in preparations of this nature—there is only one substance that is made in any quantity into which either alkyl (ethyl or methyl) enters at all. In all other cases, we buy from abroad.

2550. (*Dr. Thorpe.*) There is a slight conflict of testimony, is there not ? You began by saying that it was within your knowledge that synthetic perfumes have been made here, but that one difficulty which has been met with is, that the smell of methylated spirit has not been wholly removed. Your last answer is not quite consistent with that, because you say there is only one thing made here in any quantity ?—The point of view is rather different. Mr. Tyrer asked me first if there were any synthetic perfumes made in this country to my knowledge, and I said that some were made and sold to a certain extent.

2551. (*Chairman.*) Can you tell us by whom ?—Messrs. Bush & Company.

2552. Are they still making them at this moment ?—Yes, to a moderate extent, that is including things like heliotropine, etc., where it is simply a question of crystallisation. It is possible to dodge the difficulty introduced by the duty on alcohol by using another solvent; or in some cases, by crystallising from methylated spirit and exposing the product to a draught of air for a long period, the smell due to the methylated spirit can thus ultimately be removed. But it is a drawback.

2553. (*Dr. Thorpe.*) Are you prepared to say that in Messrs. Bush's products the use of methylated spirit has been proved to be unsuitable or detrimental ?—Yes, I am.

2554. Have they stopped the manufacture in consequence of this ?—It is not absolutely dead; it is crawling along. In a great many cases it is stopped.

2555. It is as active as ever it was, is it not ?—No. An enormous amount of work was put into the investigation of synthetic products, and the conditions for their manufacture were worked up; but it is not possible to compete. That is the difficulty. The compounds could be made almost at the same price as abroad—I mean the 5½d. tax per gallon of spirit is not much on those sort of products But the products when methylated spirit is used do not compete from the point of view of perfection; they will not hold their own in the open market, hence the manufacture has had to be abandoned. Mr. Tyrer's second question was with regard to the substances in which the alcohol actually entered into combination, and I repeat that I only know of one that was made in any quantity.

2556. From methylated spirit ?—No, from pure alcohol. They pay the duty on that, of course. It still can hold its own, because they do not know how it is made abroad; but when they do find out, I do not think competition will be possible.

2557. Of course, on the general proposition, that duty-paid alcohol cannot be used in a vast number of commerical products, that goes without saying ?—Yes.

NINTH DAY.

Tuesday, 13th December, 1904.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair*).

Professor Sir WILLIAM CROOKES, F.R.S.
Sir W. H. HOLLAND, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. W. SOMERVILLE.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*).

Mr. DAVID HOWARD, called; and Examined.

2558. (*Chairman*). You are the Chairman of Howards & Sons, Limited?—Yes.

2559. You are also President of the Institute of Chemistry, Vice-President of the Chemical Society, and ex-President of the Society of Chemical Industry?—Yes.

2560. I understand that Messrs. Howards & Sons are manufacturers of pharmaceutical products?—Yes. We have been working for 107 years.

Pharmaceutical products and fine chemicals.

2561. As wholesale manufacturers and wholesale sellers of these products of the trade?—Yes. Our business is not confined to pharmaceutical products. We make generally what are known as fine chemicals.

2562. What number of men do you employ?—About 400—or rather more, taking men and boys.

2563. Your works are situated at Stratford I understand?—They are at Stratford (London) and at Ilford.

2564. In connection with your industry will you tell the Comittee how you are affected as regards the use of alcohol?—In anything that requires the use of alcohol we find that we are at a very great disadvantage as compared with the Germans. If alcohol has to be used as a solvent for any fine chemical, denatured alcohol, or at any rate methylated alcohol, always leaves an impure product. The result is that it is much more difficult for us to get a really fine product, than it is for those who are using the pure spirit. Very often the final purification must be done with pure spirit, as it is impossible in that operation to use methylated spirit. Then we must either use duty-paid spirit, or we must have an inferior product. That often makes a very serious difference to us. In fact, it renders it impossible to make a great many of the products in England. Moreover if we make them with methylated spirit, the methylated spirit costs us twice as much as the pure spirit costs the Germans.

Disadvantage of methylated spirit as regards character and cost.

2565. Do you really say that it costs you twice as much?—Of course the prices vary. At the present moment the extra cost would not be quite twice as much; but a year ago pure German spirit was worth 10d. per gallon for sixty-four over proof, and at the same time we were paying 1s. 8d. for methylated spirit.

2566. That I think was rather an exceptional condition of things as regards the price of spirit, was it not?—It was a very cheap price for the spirit, but then at that time the methylated spirit was also at a very cheap price. We frequently pay 2s. per gallon for methylated spirit, and at the same time we can get alcohol of good quality for 1s.

2567. (*Mr. Nicholson.*) Is that 1s. per bulk gallon?—It is 1s. for sixty-four over proof.

Duty paid spirit used without hardship when spirit remains in finished product.

2568. (*Chairman.*) In certain of your products the spirit remains in a more or less free state, does it not?—It does not except in certain particular cases like salvolatile and sweet spirits of nitre. But there we make no complaint, because we can get a drawback, and that makes it possible to compete with foreign houses when exporting. There is no hardship in the case of medicines consumed in this country, even if they do cost a little more.

2569. You can recover that easily, because the same rate of duty, whatever it is, is charged upon the imported article?—Yes. We have the finished products before they are packed carefully sampled, and on the result of the analysis at the Government Laboratory we get a rebate of the duty. It works exceedingly fairly.

Mr. David Howard.
13 Dec. 1904.

2570. Now you are speaking of what you export; but as regards what you sell on the English market, there again, as I understand, you have no cause of complaint, because you recover from the consumer the full charges that are made upon you for the duty on the spirit, and no manufacturer abroad can get the same product into this country without paying the spirit duty?—That is so. There the duties work very fairly.

Methylated spirit can be used in some cases,

2571. Do you, as a matter of fact, notwithstanding the disadvantages, use a great deal of methylated spirit?—It varies of course according to the use of it. We use from ten to sixteen thousand gallons a year.

2572. I suppose for a great many purposes your only objection to methylated spirit is the cost, as for a certain number of purposes at any rate the character of the spirit is not unsuitable?—For a large number of purposes it is a question of cost. Of course there are a good many purposes for which the bodies other than the ethyl alcohol are very objectionable.

2573. Still there are, I suppose, a substantial proportion of the articles which you make with this methylated spirit, and in respect of them the methylated spirit is not unsuitable in character; and therefore in those instances your chief objection would be the cost?—It rather works out in this way—in the case of anything where we can use methylated spirit we do the work; where we cannot use methylated spirit we do not do the work, and it goes abroad.

in others it is unsuitable in character.

2574. Then there are certain pharmaceutical products which you simply cannot attempt to manufacture, because of the unsuitability of methylated spirit?—There are a very large number of those; and there are a great many other things besides pharmaceutical products—for instance, a great many fine chemicals which are used in research and so forth—which it is practically impossible to make from methylated spirit unless one so purified the spirit as to break the law. Take a very simple thing—it is not a very important matter—to make pure caustic potash the German plan is to use a pure spirit and dissolve it in that; when one tries it with methylated spirit the result is certainly rather surprising.

2575. Do you know that it is a fact that they do use pure spirit, and not a special, incompletely denatured spirit?—It may be denatured by a heavy doze of caustic potash—that would effectually denature it; but it must be pure spirit as distinguished from what we know as denatured spirit.

Finance Act, 1902 Separate premises necessary for making chemicals with duty-free spirit.

2576. It has been possible since 1902, provided the conditions could be made satisfactory to the Board of Inland Revenue, for you to use pure spirit for these purposes. I take it that one great diffieulty about that in your case is that you are using, and would be continuing to use, a certain amount of spirit on which there can be no question of relieving you from the duty?—That is so.

2577. Therefore in order to enable you to use pure spirit for those other things on which it was desired to relieve

Mr. David Howard.

13 Dec. 1904.

you from the duty, you would practically have to separate that part of your manufacture ?—Yes, we would be obliged to have an absolutely different factory.

The expense of this justified by aggregate importance of many small items of manufacture.

2578. Would it be worth your while to start quite a separate factory for those particular things ?—If the cost of inspection was not excessive, it certainly would be. Each single item is contemptible, but the aggregate is very great, and the effect on trade is very great. One constantly has to say: We cannot make this, and we cannot make that and we cannot make the other. That certainly prejudices us in the eyes of those to whom we export. I have information from wholesale druggists that it has worked against them most cruelly in that respect, because circulars are sent out to the colonies stating that their preparations are all made with pure spirit, and therefore are so much superior to the English preparations. It does not matter whether it is true or not, but the mischief is done.

2579. Still, the volume of trade that you might do in connection with these particular articles would be such as you think would justify you in setting up a separate factory, provided the cost of supervision was not too high ?—I have no hesitation in saying so.

Extent of Excise supervision necessary.

2580. The cost of the supervision would rather depend upon the nature of the processes. If, in regard to most of the processes, it was possible to denature the spirit appropriately for the process, but yet effectually, that would, of course, go very far to diminish the cost of supervision ?—There comes in my difficulty in a good many of these things. You cannot denature the spirit effectually if it is to be used as a solvent, because you distil it, and the distilled spirit would be such that I do not think it would be safe to let it loose; it would not be effectually denatured after distillation.

2581. But it would be possible, would it not, to control the recovery of the spirit by means of suitable apparatus ?—I think there would be no difficulty in controlling the recovery of the spirit. When we work with methylated spirit and recover a portion of it, it always goes straight into the tank where the methylated spirit is. I remember once that one of the Revenue officers wanted to know what the recovered spirit was like, and we had to cut a lead pipe to get him some. There was no danger in that case, because that happened to be rather more offensive than the methylated spirit to begin with. Still it could be done in that way.

Special denaturants: a considerable variety required. (*See also* Qs. 2628–33.)

2582. One difficulty that I should foresee about arrangements in connection with such a factory as that, is that you would not require one single method of denaturing, or even one or two special methods, but that you would require a great many, that is to say, that you would probably want a separate method for each product ?—For almost every single process you would want a separate method. There are certain cases, not in our business, but cases which I have a personal knowledge of, where it would be an immense advantage. Take some of the varnish trades—it would be an immense advantage to them to have pure spirit as against methylated spirit. I know of one case where a manufacturer of a poisonous paint represented to me that the relative solvent powers of the two were different, but in that case there would be no difficulty in putting poison into the spirit, if it was easy to get a small quantity of the spirit specially denatured without great cost—and of course 1,000 gallons is a very small quantity of spirit.

2583. But the quantity of spirit that you would use for each separate article would not be very large, and under the hypothesis I am putting, that quantity would be differently denatured according to the article that you were going to make ?—I think there is one article which is of great interest to exporters, though it does not make much difference to us. It is also of great interest to certain manufacturers. That is ether. If ether could be made in bond and could be exported in bond, that would save an infinity of expense and difficulty. The difficulty of getting small quantities of ether from abroad and exporting it in bond, are such that I have known small quantities cost a good deal more than the duty on the ether; the exporters would have done better if they had bought ether made from duty-paid spirit. I am speaking of a comparatively small order. It was a Government order, and it worked out so that it was almost a farce—such was the way in which the special expenses in connection with small quantities in bond worked out. It was something extraordinary.

Ether. Advantage of manufacture and exportation in bond.

2584. Where would the exported ether find a market—in the Colonies ?—Yes. There is another very important point. A great many explosives are made with ether. I am not an expert in explosives, but I was approached the other day by some very important manufacturers of explosives who asked: Could we produce ether at the same price as the Germans ? Our answer was: "Given spirit at the same price, of course we can." The cost of the German ether was something a little under 4d. per lb.; the cost of the methylated spirit to make 1 lb. of ether was just about 4d.; so, of course, it was impossible for us to do it. Moreover, for his purpose, he said: "If you give me methylated ether, I cannot use it unless you have removed every trace of the double ether that you make when using methylated spirit.

Present cost of methylated spirit prevents competition with German ether.

2585. That is held to be true, at any rate, as regards the manufacture of explosives, but is it true of many things ? As a matter of fact, ether produced from methylated spirit varies very much in purity, first of all, does it not ?—Yes. I have a very strong opinion myself that it ought to be made illegal to use any ether for internal use except that made from pure spirit; but it is, I believe, lawful to do it, and it is very largely done. But one can purify it, at a very considerable cost, till 98 per cent. of it is pure ether.

Ether from methylated spirit. Its suitability for various purposes.

2586. In the process of manufacturing the ether, is it not the case that different runnings are of different purity, and that some of the runnings are hardly distinguishable from ether made with pure spirit ?—In rectifying it with a powerful still, one can get off almost entirely by itself the ethyl-methyl-ether, that is, the double ether which is formed by the methyl.

2587. For your purposes, would not ether made from methylated spirit be quite suitable in a large number of cases ?—Except for the question of the cost, it would be perfectly suitable. In certain cases it is even better. For local anæsthesia the first runnings which give an extremely light ether are positively more powerful than pure ether.

2588. (*Dr. Thorpe.*) They are more volatile, are they not ?—Yes, they are. How far it is desirable to use it as an anæsthetic for internal use, I do not express an opinion. I should rather that a physiologist should speak on that. I know it is done, and I am rather doubtful about it.

2589. (*Chairman.*) Do the correspondents from the Colonies at present, who want ether from this country, insist upon ether made from pure spirit, or are they satisfied with ether made from methylated spirit ?—As a rule ether made from pure spirit is so much cheaper that if it is a large quantity they want they will have that.

2590. There again it is more a matter of price ?—Yes. I believe, for instance, almost all photographic work is done with methylated ether.

Suggestion of co-operative manufacture of chemicals in bond. (*See also* Qs. 2626–7 and 2687–93.)

2591. Supposing you establish a separate factory in which to manufacture things that really did require pure alcohol, do you suppose that you would do it entirely by yourselves, or in co-operation with other manufacturers ? It would be a thing which I should think would be much better done in co-operation with other manufacturers, because the same inspection would be satisfactory for all.

2592. Do you suppose there would be any great difficulty about securing that amount of co-operation ?—I do not think there would. Of course it is very difficult to tell, but the general expression of opinion I have heard is rather in favour of it.

2593. Would it not rather tend to create something of a monopoly ?—I do not think it would create more of a monopoly than there is at present, because the Germans have a monopoly of it.

2594. At any rate it would mitigate that monopoly ?—Yes.

2595. (*Dr. Thorpe.*) But it would create a home one ?—I do not know that there is much danger of a monopoly being created where there is a possibility of anyone else, if it becomes too profitable, starting on the same terms.

2596. (*Chairman.*) At any rate you have the competition of the imports from Germany to keep down and regulate the price ?—You certainly could not get beyond that price.

Prospects of meeting German competition with duty-free spirit under Finance Act, 1902.

2597. Have you approached the Board of Inland Revenue at all under the Act of 1902 ?—We read the conditions very carefully, and we could not honestly say that the work we proposed came under those conditions. We could not say that it is of great national importance. Undoubtedly it is carried on for our own profit, if it is carried on at all.

2598. Still, although the separate articles manufactured may not be of national importance, and although the business of any one firm may not be of great national importance, if the total of the whole, the aggregate of all the articles and of all the manufactures, is large, then it would become of national importance ?—I think it is of national importance. We have rather asked questions, and we have never made a formal application. We gathered that the idea of working in bond was not considered desirable, and that that really was the only way in which we could imagine it in working it out. I think if we could not have made quinine without pure spirit, we should have come forward to see what could be done.

2599. Would it be possible in your present works to separate off any portion of them ?—I think it would mean building new ones.

2600. It would ?—Yes; when works are a hundred years old it is better to build than to alter.

2601. Do you feel pretty confident that if that were allowed you would be able to manufacture at a price which would enable you to compete with the Germans ?—I only judge from experience. Where we have anything like even terms I think we can hold our own. We have held our own in quinine, and we have held our own in caffeine, where we did not use spirit, but where it might be used. Then we hold our own in inorganic chemicals, where no spirit is used. I may be flattering myself, but I think an Englishman is not such a bad second to a German.

Cheapness of spirit in Germany a disadvantage which must be faced.

2602. The point I was coming to is this: Are you assuming that it would be possible in this country to provide you with pure spirit at a price no higher than as a rule prevails in Germany ?—As far as I know spirit in bond in the London docks is at least as cheap as it is in Germany.

2603. Is it certain that the price of spirit in bond in this country is not sometimes, at any rate, below the price at which your competitor in Germany could obtain the spirit ?—That is why I spoke doubtingly, because my impression is that the 10d. per gallon was an exceptional price which was owing to the excess stocks which had been forced off. 1s. per gallon I believe is about the average price.

2604. We have had it in evidence I think—at least it has been mentioned in conversation, if it is not in evidence—that the cost of producing spirit in Germany is not lower than the cost of producing spirit in this country; but that there are special arrangements favoured by the Government regulations and worked by the trade organisations which result in giving certain people spirit at less than cost price ?—I have no special knowledge of it, but I have a good deal of knowledge of the German business, and I should think it was extremely likely.

2605. So far as that particular form of German competition goes, you would have to face it, whatever we did ?—One must face that. It is no worse than it is in other things.

2606. That you would not be afraid of ?—No. One would not like it, but I do not think it would prevent us working.

Chloral hydrate. Inadequacy of import duty. (*See also* Qs. 2665-8.)

2607. In your *précis* you have mentioned chloral hydrate; can you not manufacture that ?—No, and we never did. I went into it very carefully when it first came up, and I fully convinced myself that the waste must be greater than the duty. I cannot remember the name of the manufacturer, but I know it was made unsuccessfully in England. That is a very good example of the difficulty of a duty. I have no doubt that the duty was worked out most carefully and on apparently good grounds; I certainly do not suppose it was arrived at lightly. But where there is a very great waste, it is impossible exactly to assess the waste, and it is impossible unless an amount of duty is charged which is of the nature of a protection, to provide for everything. Stills will leak and men will make mistakes and so forth; and then unless there is a margin, with anything so terribly costly as duty-paid spirits of wine it is impossible to go on.

2608. The duty now is 1s. 4d. per lb. ?—Yes, and it seems a very large duty.

2609. What would that work out at to on the gallon ?—There are 8¼ lbs. to the gallon.

2610. Then it would be about 11s. per gallon on the chloral hydrate, would it not ?—I do not know what the specific gravity of the chloral hydrate is. I have no doubt that that is more than the theoretical duty ought to be, but it is not enough. If it could be manufactured in bond and the duty paid when it came out, I do not see any possible reason why we should not work it as well as the Germans.

2611. Assuming that the duty when it came out is 1s. 4d. per lb. ?—Yes.

Pharmaceutical products requiring alcohol for their manufacture.

2612. (*Mr. Tyrer.*) I agree so cordially with all that you have said, that I have very little to ask except as regards a point on which we have asked several questions before. It relates to a list of preparations with which you are familiar—aconitine, atropine, butyric ether, cantharidine, chloral hydrate, cocaine, eserine, hydrokinone, iodoform, phenacetine, salicylates, santonine, chloroform, sulphonal, thymol, vanillin and so on. Might I ask you in which of those in your opinion spirit is not necessary ?—I think spirit is necessary more or less in all of them; that is to say it is possible to make them without spirit, but not according to the requirements of modern trade.

Cocaine.

2613. Would you say that of all of them ?—Chloroform you can make without spirit. Cocaine is rather an example. We used to be rather large makers of cocaine, but for that you must use absolute spirit or you hydrolyse. We do make a small quantity now, using absolute duty-paid spirit, but the price is a deterrent except for those who would rather have our guarantee. For iodoform it would be a great convenience to have pure spirit, but the difficulty about alcohol certainly does not prevent our making a great many tons in the course of the year.

Butyric ether.

2614. Mr. Grimwade, when giving evidence before this Committee at question 1973, gave us the following list of products, as being to the best of his belief those products which he had to buy abroad, because they could not be produced here:—gallic acid, tannic acid, chloral hydrate, cocaine, eserine, guaiacol, paraldehyde, phenazone, phenacetine, pilocarpine, salicylates (acid and soda), santonine, sulphonal, thymol, aconitine, antipyrine (lion), atropine and salts, butyric ether, cantharidine, heliotropine, vanillin, capsicine, gingerine, resin scammony and male fern oil. Some of those he admitted he did not know of, but the majority I think cannot be made economically here, can they ?—Might I take as an example butyric ether ? Theoretically it ought to be easy to make it; but as I believe, the universal process of the purification of the butyric acid as practised in Germany is by the distillation of the ether; and there, of course, the consumption of the spirit is enormously greater than it ought to be. You may recover a certain portion of the spirit, but you would use a great deal more of the spirit than you ought to. You purify your ester instead of merely purifying your acid, and making a pure ester. All those things, as far as I know, are not produced in England. I do not carry it all in my head, though I ought to do so; but in those things which I have gone into in those lists, it has been alcohol that I have run against—in each case.

Iodoform.

2615. Of course, in the case of gingerine and capsicine if they are allowed to be made here with methylated spirit then it becomes simply a question of whether that is any detriment to the flavour; but even then you would be of opinion, would you not, that with methylated spirit used under ordinary conditions there would be a disadvantage as compared with the spirit under the conditions in which it is used in Germany ?—Undoubtedly, the price would tell. You mentioned iodoform which we do make and which we crystalise from methylated spirit. It is very fortunate for us that iodoform smells so nasty, or I think people would complain of ours as against the Germans', because there is a very distinct flavour of methylated spirit about it, even after all we have done.

13 Dec. 1904.

2616. (*Chairman.*) Iodoform itself is bad enough ?—Yes. In that case I do not think it matters.

Such preparations, even if made in United Kingdom, purchased more cheaply abroad.

2617. (*Dr. Thorpe.*) I should like to be quite clear in my own mind what your meaning is. Am I to gather from your answer that none of the things mentioned in question 1973, are made here ?—Aconitine is, I believe, made here in very small quantities, and a special quality of atropine is, I believe, still made in small quantities, but the great bulk of the trade goes abroad. In the case of any one of those things, including cocaine, if I wanted to include them in an export order I should go abroad for them.

The price of alcohol assigned as the reason for this.

2618. That is not quite a direct answer to my question. You might I daresay, and probably you would ; but I shall be able to show to the Committee that you could include a great many other things which could be made here in which spirit is not in any way concerned, but which you can get cheaper in Germany. What you say is true, but it is not quite the point ?—When things have been made successfully in England and the Germans have beaten us out of the field, one always asks what the difficulty is. As far as I can see, in those things the difficulty has been the spirit.

2619. That is, you have assumed that it is the spirit ?—As far as I can see it is the spirit. Of course one has to assume, ultimately.

Chemicals not requiring alcohol. (*See post* Qs. 2675–84.)

2620. I think I shall be able to show you that there are a great many fine chemicals, as they are called, made both here and in Germany, into which no spirit enters either directly or indirectly, but in regard to which you cannot beat the German ?—Of course there may be a question of patents ?

2621. No ?—Or there may be a question of experiments on animals ?

2622. No ? I am referring to the ordinary commonplace chemicals, the so-called fine chemicals made in relatively small quantities, which are systematically made 20, 30 or even more per cent. cheaper in Germany than they are here ?—I am not aware of that.

2623. It has been stated that chloral hydrate is made —not has been attempted, but is made—in this country ; are you aware of anybody who makes it ?—No, I wish I were, because one would certainly go to Englishmen if one could. I have not heard of it, and I have made a good deal of inquiry.

2624. Do you know whether the same remarks applies also to synthetic perfumes ?—You must not ask me about synthetic perfumes. All I know is that synthetic perfumes are always nasty. But I really know nothing about them, and I had better not speak to them.

2625. I thought, perhaps, you might have heard about them ?—It is the merest hearsay evidence, and I do not know that that is worth having.

Co-operative working in bond. (*See* Qs. 2591–606, 2687–93.)

2626. At any rate I gather that you have very little doubt in your own mind that one of the means of getting out of the difficulty is co-operative working in bond ?—That is the only way that I can see that would give a chance.

2627. And you have a pretty confident belief that there would be no very great difficulty, so far as individuals at any rate are concerned ?—As far as I can judge, there will not be. As far as the Inland Revenue officers are concerned. I am certain of this from long experience—that anything can be done in the way of watchfulness, without in the least being vexatious and troublesome, will be done.

Special denaturants for pharmaceutical products. A considerable variety required. (*See also* Qs. 2582.)

2628. (*Sir William Crookes.*) There is one little point I should like to draw your attention to. You say you make a very large number of fine chemicals in comparatively small quantities in which alcohol is required ?—Yes.

2629. But that the agregate mounts up to something important ; therefore the consumption of alcohol would ?—It would. Where the alcohol becomes expensive we have to give it up.

2630. Could you use it if the alcohol for each separate operation were denatured by a method which fitted that operation ?—In a great many of the cases we could.

2631. In that way, then, you would have a very large quantity of different samples of alcohol ?—Yes—denatured for a particular purpose.

2632. Unless you happened to hit upon exactly the amount of alcohol which was required for each purpose you would have some left over, or you might not have enough alcohol for a particular operation ?—That is so.

2633. Would there not be a danger of waste and loss of alcohol by all those little aggregate excesses, that would be unavoidable in working ?—If each had to be worked absolutely by itself, it would be extremely difficult to carry out. What was in my mind was a general working in bond under supervision, and accounting, as in a factory one has to, whether one is under supervision or not, for all the materials ; but not necessarily that the thing must be absolutely kept to a particular purpose.

2634. (*Mr. Tyrer.*) Have you any notion whether that is the method and arrangement adopted in Germany ?—I know nothing about the arrangements in Germany as regards the details of supervision, except what I owe to your published papers.

2635. You have considerable opportunities, as you have told us, and as I know, of meeting your German competitors ; has it ever occurred to you to ask—I know how difficult it is always to ask questions about business and the details of manufacture—how the supervision, and the regulation with regard to the use of spirit, work among your competitors ?—As our chief competitors abroad are quinine manufacturers, and I believe none of them use alcohol now as a primary material, it has never struck me to ask them.

2636. Are some of them, may I ask, who are interested with you in common, manufacturers of a wide range ?—Some of them have a very wide range.

2637. Would it not be doing yourself a service and the nation too, from another point of view, if you were to inquire—and you know so well how to put it diplomatically —what sort of supervision they are subjected to ?—I daresay I may have an opportunity ; but it is a little delicate, and one cannot ask too many questions of one's friends.

2638. I admit the delicacy.—If I can get on to the subject I will. Of course I hear a good deal about what goes on.

2639. (*Dr. Thorpe.*) I do not think there would be any more difficulty in asking that, than there would be if they asked you what amount of revenue supervision you are subject to ; I suppose you would have no hesitation in telling them ?—No, but one has to be a little careful not to give them an idea that one is fishing for what solvents they use.

Advantage to British labour from freer use of alcohol.

2640. (*Sir William Holland.*) Anyway, we may take it, I think, that you admit, broadly speaking, that Germany has great advantages over this country because of its cheaper alcohol ?—In the branches I have been speaking of, yes.

2641. And therefore the interests of both labour and capital here would also be advantaged if improved conditions could be had ?—I think it is more labour than capital that would gain, because, if one can buy something cheaper abroad and sell it, that does not hurt the capitalist, but it does hurt the labourer.

2642. You have spoken of the establishment of a new works. That would be an advantage to labour and capital here, would it not ?—It would mean more men employed.

2643. Both capital and labour would participate in the advantage of it, probably ?—Yes.

Cost of methylation, if not more than 3d. a gallon, not a very serious matter.

2644. (*Mr. Nicholson.*) You have told us that even when methylated spirit is suitable for your purposes, the cost of methylating is a serious drawback to you—at least so I understand ?—Yes. I do not know what the cost of methylating is, but I know the relative relations of the two prices.

2645. We have had it that it is approximately 3d. per gallon ?—But there is more than that surely—there is the differential duty.

2646. I am speaking of the cost of alcohol in this country as compared with the cost of methylated spirit in this country ?—As I say, I only know two prices. I know what the cost of methylated spirit is, because I draw cheques for a good many thousand gallons ; and I know what the cost of pure spirit is, because I equally have to

draw cheques for it. Take the cost of ether. If we might have pure methyl alcohol and pure ethyl alcohol, it would be a beautiful thing to make ether of. But the result of the ketones and other bodies in it, is that the sulphuric acid gets in the most horrible mess, and we get abominable compounds which I have never been able to excite the interest of any chemist in yet; but they are a very great disadvantage. In that case it is not the 8 per cent. of methyl which we complain of, but it is the 2 per cent. or whatever it is of the other bodies.

2647. (*Mr. Tyrer.*) Supposing the authorities allowed a purified methylated spirit, that is to say, after it had been distilled over caustic alkali and so on—but that it still contained methyl alcohol, would that be an acceptable form of denaturing for certain purposes?—That is a thing which it is difficult for me to suppose, because I have always most scrupulously avoided experimenting with purifying methylated spirit. I have longed to do it, but I have never done it.

2648. (*Mr. Nicholson.*) The price of alcohol for methylating purposes in bond may be taken at approximately 1s. 4½d. for the strong gallon, and the price of methylated spirit may be taken roughly at 3d. higher. Is the Committee to understand that that is a serious disadvantage to you in cases where methylated spirit might be employed for your purposes suitably?—The 1s. 4½d. I should have thought was a very high price for pure spirit in bond. We buy spirit quite pure enough to make ether in very large quantities at a great deal under that.

2649. At the present time?—The last quotation I got was one shilling.

2650. For pure spirit in bond?—For strong spirit; it was 6½d. per gallon proof.

2651. Then I can only suppose that you bought last some months ago?—It was three or four months ago.

2652. I do not know whether you will take it from me, but such a price does not exist at the present time?—It was some two or three months ago, I know. The last quotation I saw was 1s. 0½d. for 64 O.P.

2653. I have a quotation here from Ridley's Trade Circular which was issued on the 8th, and absolutely the lowest price then of spirit in bond was 1s. proof?—Then we have made a very fortunate contract.

2654. Taking the prices that I have given you, 1s. 4½d. and 1s. 7½d. respectively, may the 3d. be taken as being a serious drawback to you?—The 3d. is not a very serious drawback, but I have never known methylated spirit within 3d. of pure spirit yet.

2655. (*Chairman.*) That is not in large quantities?—Not in large quantities.

2656. (*Mr. Nicholson.*) I can only ask you to take it from me that it is so at the present moment?—Might I say that I daresay that the spirit we use to make ether with is not quite what one would use to drink, because the sulphuric acid effectually disposes of a little aldehyde or other such impurity.

2657. (*Dr. Thorpe.*) You could not drink the spirit that is made into methylated spirit, do you mean?—No. I am talking of making pure ether. A trace of aldehyde which would not improve it for drinking, would soon disappear under that gentle treatment.

2658. (*Mr. Tyrer.*) In other words, you use a quality of spirit that would be used for methylating?—I should think so. It would be a little purer perhaps.

2659. (*Dr. Thorpe.*) That is a little purer for ether?—It must make a perfectly sweet ether, or of course it will not do.

2660. Would you use it less strong than it would be for methylating?—We generally use it 64 O.P.

2661. That is about what would be used for methylating?—Sometimes we get it 72 O.P., but that is rather rare. We take it as we get it.

2662. (*Chairman.*) However, what we come to is this, that if the difference between pure spirit and methylated spirit were no more than 3d., that would not be such a very serious consideration?—Not if one was quite sure that the Germans were paying the same high price for pure spirit.

Mr. David Howard.

13 Dec. 1904.

2663. (*Mr. Tyrer.*) It has been stated several times here that when one talks of pure spirit for certain purposes in Germany, we are speaking of a spirit which has had concessions; in other words, that in Germany they have piled it on the home consumer and taken it off for manufacturing purposes?—As I say, I really do not know anything of my own knowledge of that; but still 5d. per gallon always will make a difference to us.

2664. Per proof gallon?—5d. per proof gallon is 8d. 65 O.P.

Chloral hydrate. Inadequacy of import duty makes importation cheaper than manufacture. (*See also* Qs. 2607-11.)

2665. (*Dr. Thorpe.*) About this question of chloral hydrate, you say you are not aware that chloral hydrate is made to any great extent in this country, if at all?—I am not aware of it.

2666. It is perfectly true, of course, that chloral hydrate is imported, and we know exactly to what amount, because the returns show it. It is perfectly true, also, I think—at least I take that from you—that the countervailing duty on chloral hydrate is not adequate?—As far as I can make out it is not.

2667. The probability is that it is not, but we have no accurate data upon which to calculate it. I may say that I had nothing to do with the calculation of this particular countervailing duty, as it was before my time; but I have looked up the papers, and I find that all the data upon which the duty was calculated are in existence. As regards the question of waste, which is one of the principal factors in determining the countervailing duty, our data were probably extremely imperfect. Therefore it is very possible that the countervailing duty has not been properly calculated. Is it not the fact that it has been found by practice that the price at which chloral hydrate can be sold in this country, having regard to the countervailing duty, makes it more economical to import it than to make it?—That is so. I do not want there to to be the least misunderstanding. I am not in the least venturing to blame, or thinking of blaming, those who worked out that countervailing duty. I rather take it as an example of the extreme difficulty of fixing a countervailing duty which shall be at once a fair duty, and shall not give a heavy premium on the man who is a little more careful than his neighbours.

2668. (*Mr. Tyrer.*) What is the price of chloral hydrate?—I am afraid I cannot say.

Pharmaceutical products not now made from pure duty-free spirit in Germany.

2669. (*Dr. Thorpe.*) You have said that you are not quite familiar with the procedure in Germany. Do you know, as a matter of fact, that the class of articles, for the manufacture of which from pure alcohol you ask that facilities should be given in this country, are actually made from pure alcohol in Germany? The allegation is, of course, that these things require pure alcohol to make them, and that it is because of the relatively high price which is put upon pure alcohol in this country that they cannot be made here?—They are not made from methylated spirit and they are not made from pure spirit; that is about as far as I can go.

2670. If they are not made from methylated spirit and if they are not made from pure spirit, what are they made from in Germany?—As far as I know, there is a good deal of denaturing *ad hoc*, under an amount of supervision which, I think, speaks well for the honesty of the German manufacturer.

2671. We will, if you do not mind, go into that question. Here is an official publication, which is brought down to March 1904, which gives exactly what the denaturants are that can be used in Germany. What you call denaturing *ad hoc* is rarely practised in Germany, and mainly in the manufacture of ether, where sulphuric acid is allowed to be used. In nearly all other cases, one or other specific denaturing substance must be used. There are five main substances which may be used, namely (1) half a litre of pyridine bases, added to a hectolitre of alcohol; (2) half a litre of turpentine oil added to a hectolitre of alcohol; (3) one litre of benzol added to a hectolitre of alcohol; (4) ·025 of a litre of animal oil added to a hectolitre of alcohol; (5) alcohol with 10 per cent. of ether. Those are the five substances which the chemical manufacturer who makes these fine chemicals may take his choice of which he uses. By the Act of 1902, which came into operation in 1903, none of these things are allowed to be made from pure duty-free alcohol. The concession which was given for the manufacture of pharmaceutical products prior to 1902, has been taken away;

The German denaturants.

Mr. David Howard.

13 Dec. 1904.

and, therefore, it is a fact that, for these so-called fine chemicals and the other things which you now claim to be allowed to use pure untaxed alcohol for, pure duty-free alcohol is not allowed to be used in Germany ?—Might I point out that it is perfectly and absolutely certain that the finishing and final crystallisation of the alkaloids, for instance, is not made with any of those mixtures ? That you can be perfectly certain of from the odour of the finished alkaloid. It may be that owing to the much smaller duty on alcohol in Germany they can afford to use pure spirit; but it is perfectly certain that those mixtures are not used in the finishing processes. It is perfectly certain, for instance, that they do not crystallise codeine from one of these mixtures.

2672. Why ?—Because the smell would be intolerable.

2673. You have begged the whole question there; you have never tried them ?—I certainly have never tried any of these particular things; but then I have tried a good many other things. I have worked with pyridine for other purposes, and you cannot get rid of the smell, I know, because when I have got it into my solutions from fusel oil it has adhered to the finished product with the most horrible pertinacity—there is a little pyridine in a good deal of fusel oil—and therefore I know what the result is in the finished product.

2674. And there is some in methylated spirit, as we know, that is what we value ordinary wood naptha for. That is perfectly true of pyridine, but would you say that those other things which you might have the selection of, assuming that you were working in Germany, would be equally detrimental ?—The information that I have of German work is earlier than that, I confess. I do not know how they have adapted themselves to it, and I do not know how far they are allowed to re-distil some of these compounds.

Price lists of English and German firms compared as regards articles in which Alcohol has no part.

Comparative cheapness of German articles. Explanations suggested.

2675. That is the state of affairs. I believe a great many of the allegations that have been made, all in good faith, are based upon practices which existed prior to 1902. In some cases, the allegations have been made on absolutely imperfect knowledge. Another point, which I feel a certain amount of diffidence in putting to you, relates to the point that I have discussed already with you. I suppose, in common with every person at the head of a laboratory, I am inundated with price lists from German, French and English manufacturers of such chemicals as we use in the laboratory as re-agents, and for purposes of research—the so-called fine chemicals. I have taken the pains—my investigation is not quite complete, because I want it to be fairly exhaustive— to take out from these price lists the prices which are asked by German manufacturers for the so-called fine chemicals which are used by myself and by other heads of laboratories, and to compare them with those which are asked by the competing English houses. Generally speaking, I should like to ask you, is it or is it not the fact that the prices asked by the English houses for the manufacture of these things, even those in which no alcohol whatever is concerned, are dearer than the prices asked by their German competitors ?—That is a question which one can hardly answer in that form, I think. Undoubtedly, if you compare the price list of a man who wants to get into new ground with the price list of a man who is already in possession of the ground, you will find that his price list is frequently lower. I have known such a thing happen in German markets. We have quoted prices a great deal lower than the Germans were charging, and they did not like it. Then again there is considerable difference in the circumstances. Quantity makes such an enormous difference. In many of those cases, the price lists compare different quantities and different circumstances. Moreover, very often a price list is a statement of what one will sell to anybody; but an important buyer will get it a great deal lower.

2676. That applies to one trader as well as to another, surely. I will take actual circumstances. I will take, for example, the price list of Hopkin & Williams, which I have no doubt you know something about, and I will take price lists of such firms as Schuchardt, or Trommsdorf, or Kahlbaum and others—in fact, the class of men who supply the German laboratories with fine chemicals, just as the firm of Hopkin & Williams seeks to supply the English laboratories with fine chemicals. Comparing those price lists for fine chemicals in which the alcohol question does not enter and does not complicate the situation, therefore, I find that the prices which are charged by those German houses for those fine chemicals range from 15 to 35 per cent. less than English houses charge. Therefore, I say you cannot argue that certain fine chemicals in which alcohol is concerned owe their difference in price to the alcohol, when large numbers of substances in which no alcohol whatever is concerned are equally different in price ?—May I suggest that I do not think a price list is ever fairly compared with another price list, without considering a vast number of questions ? The amount of the particular article which is asked for, may be of a thing which is very little used in one place and is largely used in another. Under those circumstances, naturally any one who holds stock where it is little used, charges more than the one who holds stock where it is largely used. Then again, as I said before, there is the widest difference between price lists which are sent for special purposes and price lists which are sent for quite another purpose. I do not think there is anything dishonourable in keeping one price list for those who will buy £5 worth of goods in a year, and another price list for those who will buy £1,000 worth of goods in a year. I do not know what people pay for a small bottle of quinine in the shops, but I know what I get for it, and I know they bear not the smallest relation to one another

2677. May I point out that the prices which are quoted in these lists, which are all addressed to the heads of laboratories, are all subject to the same discounts and rebates and trade terms, probably—so far as I know, they are. The prices are so different that I cannot conceive, for example, of a firm like Hopkin and Williams waiving a price in order to compete with such prices as are asked for by their competitors in Germany. For example, Hopkin & Williams ask for pure arsenious acid—a substance which is made in this country—8d. per lb., whereas I can get it from German houses—there are three that I will give you, Heinsch, Hahn and Schuchardt—at prices ranging from 4d. to 5¼d. Even for such a common thing as pure hydrochloric acid the English firms would charge me for a lb. at the rate of 9d., wher as those same German houses offer it to me for 2d. or 2¼d. I could go on multiplying instances of this kind of thing. These are differences of prices which are commensurate with the differences of prices in so-called alcohol derivatives; and therefore, I say you cannot assert that the difference in price is due to alcohol in the case of alcoholic derivatives, when you are face to face with prices like these for fine chemicals into which alcohol does not enter ?—Might I ask whether it has always been certain that the same articles are offered in each case ? "Pure hydrochloric acid" may mean something which has been carefully tested, and which one fails to find the smallest trace of arsenic in; and "pure hydrochloric acid" may mean something which will pass the flame test of Marsh's test, but certainly would not pass anything else. Then, again, the quantities which are asked for do make such an enormous difference. If anyone wants a large quantity of arsenic acid it can be produced in England as cheaply as in Germany. Moreover, the prices of many articles on these lists are distinctly lower than the prices on the home lists of the same makers. The argument does not seem to me to prove much. Might I point out that no one has any idea of the difference in the cost of production as governed by the amount of the product that is required, unless they have tried it. If anything is demanded in large quantities, it can be produced at a very small fraction of what it costs if it is produced a little at a time. It is possible that in certain cases there may be a difference—old processes, for instance, may have been adhered to. I do not say that there is no possibility of progress or of cheapening; but the question of quantity does so govern both the cost of production and the cost of distribution that I do not think it in the least follows that one of those lists can be compared with another unless one knows the entire circumstances of the case.

2678. The quotations in the German lists are almost invariably, when the amounts are large, either per kilogramme or per 100 kilogrammes; and in England, as a rule, they are per lb. or per cwt., so that the circumstances as regards quotations for quantity are comparable ?—I said the quantity of the total amount which is demanded. I do not think that the quotations which you have been reading are for 100 kilogrammes—some of them, at any rate, I should think are not.

2679. (*Chairman.*) You said just now that the price-lists sent from England differed from the price-lists circulated in Germany ?—Yes, I know they do.

2680. Do you mean, you know that as a fact ?—Yes.

2681. (*Dr. Thorpe.*) As regards chemical laboratories, I venture to say that that is not so, but that they are precisely the same. The lists I get from Kahlbaum's are certainly the same that are sent to Professor Emil Fischer or Professor Curtius of Heidelberg ?—With regard to the price of 9d. per lb. for hydrochloric acid, I think it would be well to know what quantity was asked for.

2682. (*Chairman.*) You do not regard those lists as being really any indication at all ?—I do not in the least. Take Epsom Salts, for instance, which have been mentioned in conversation. They are produced as a secondary product in a great many manufactures—as a by-product. If you do not mind a trace of chloride, you can get them very cheap. A little arsenic is commonly found in them. But if you want to make them perfectly pure they are double the price, or possibly even treble.

2683. (*Mr. Tyrer.*) Pure enough for medicinal use, do you mean ?—It depends upon what you want. They may be pure enough to look tolerably nice.

2684. (*Dr. Thorpe.*) In making this comparison I have been as scrupulously careful as I could in order to be fair to both sides. I have taken not only the list of Hopkin & Williams, but other lists which I have had. There is Mr. Webb's list, and there is our friend Mr. Tyrer, who supplies me with chemicals in the same way; and I say to this Committee deliberately that for a great many of these so-called fine chemicals I could do better if I went to German houses for them ?—May I again point out that I do not think that the question of minute quantities of these things affect the point in the least ? Then there is the question of distribution. Why, the cost of putting up half-a-pound of hydrochloric acid into a bottle and tying it over and sending it about town is a great deal more than the cost of production of the stuff. The only thing is to compare things of considerable importance, and where they are on something like even terms; and I do not see where in those things there is any evidence of incompetence.

Mr. David Howard.

13 Dec. 1904.

2685. (*Mr. Tyrer.*) I have this morning received this circular from Merck, which came with the letters, and therefore is up to date. I have crossed out the things that have nothing to do with the question. Take the top list; would you be good enough to read it and say whether most of those require spirit or not ?—I should certainly consider that I should have to use spirit for every one of those alkaloids, and I cannot beat Merck in regard to them. But in regard to these other things, take acid benzoic; I can beat Merck in that if he makes it out of Gum Benjamin, which I do. Take Butylchloralhydrate; I do not know how to make it without alcohol.

2686. (*Chairman.*) Is that a price list you are referring to ?—No, it is only a circular-notice.

Co-operative working in bond. (*See also* Qs. 2591-6 and 2626-7.)

2687. (*Dr. Somerville.*) I think you have said that you can only see that pure alcohol can be used in this country under a system of co-operative manufacture; did you say so ?—No; I said that would be a most desirable thing.

2688. I do not know whether other members of the Committee have a clear idea of what co-operative manufactures means or not; I confess I do not know what it means in this particular connection ?—Manufactures might conjointly combine to make, in bond, the same thing, or a number of things, which require alcohol.

2689. Do I understand, then, that you would have a bonded factory ?—Yes, that is it.

2690. And that various manufacturers of certain specific substances who wanted to use pure alcohol would carry on the processes of the manufacture under one common roof ?—That is what was in my mind.

2691. I suppose that there can be no trade secrets under these circumstances ?—No, and that would be an inconvenience in some respects.

2692. (*Mr. Tyrer.*) But not a serious one, would it ?—There are not so many trade secrets as people think. It chiefly consists in, as the painter said, mixing the colours with brains.

2693. It practically means, when it comes into shape, that those who are interested would have to capitalise the thing, and they could share, appointing a general manager who would act for them ?—Yes.

Mr. Edward Alfred Webb, called; and Examined.

Mr. E. A. Webb.

13 Dec. 1904.

2694. (*Chairman.*) I believe you come here as a representative of the London Chamber of Commerce ?—Yes.

2695. You yourself are what ?—I am a wholesale druggist, of the firm of Evans, Sons, Lescher & Webb, Limited, of Liverpool and London.

2696. Are you manufacturing druggists ?—Yes.

2697. On a large scale ?—Very large.

2698. Where are your works ?—In Liverpool.

2699. What number of men do you employ ?—Down in Liverpool altogether about a thousand.

2700. In the works ?—In the works I should think it would be about 400. A wholesale druggists' work does not require the same number of hands as the works of a large manufacturing chemist.

2701. Do you deal only in the non-heavy chemicals ?—We deal in all sorts of chemicals, the heavy chemicals as well as the others, that is, if you call cream of tartar and tartaric acid heavy chemicals.

2702. But you do not manufacture them ?—We manufacture no heavy chemicals.

2703. Do you find that you and other manufacturers in this country are precluded from making certain chemicals by reason of the want of pure and untaxed alcohol ?—Yes.

Distribution of chemicals to Colonies and abroad.

2704. Would you name two or three ?—I have given a list in my *précis*, but I am not here so much to speak about their manufacture as about their distribution. Mr. Umney, who will follow me, will deal with the manufacture. We thought we would save your time by dividing it up in that way. I have prepared four schedules illustrating the distribution, which I beg to hand in. (*See* Tables on pp. 115-6.) Schedule 1 is a list of the articles which might be made here, and there are others besides.

Preparations requiring alcohol, which are not made in United Kingdom, or only on a small scale.

2705. I think you sub-divide that list into three heads—(1) those that are not made in this country in consequence of the alcohol difficulty, namely, gallic acid, tannic acid, chloral hydrate, heliotropine (probably), hydrokinone (probably), paraldehyde, phenacetin, phenazone, salicylates, santonine, sulphonal, and thymol; (2) those that are are not made in this country in consequence of patents granted to foreigners, namely, guiacol carbonate and vanillin; and (3) those that are made in England in a small way, namely, aconitine, atropine, butyric ether, cantharidin, cocaine, eserine and pilocarpine ?—Yes, that is so.

2706. For all of those do you consider that pure alcohol is required ?—Yes, directly or indirectly.

2707. Is your trade largely in the home market, or do you have a large trade in export as well ?—Both.

2708. Your export business would be, I suppose, mainly to the colonies and British possessions ?—Yes. Our business in London is with the British Colonies, India, China, and the Straits Settlements; but from Liverpool we ship to Canada. We also ship some things to the United States, but not largely, and we do a large business with South America and the West Indies. So that the nature of the businesses at the two ends is different.

Such preparations supplied to colonial chemists in relatively smaller quantities than to chemists at home.

2709. In your export business do you supply wholesale houses in the colonies, or is it an export business on orders from retail houses ?—It is a business on orders from retail houses. The wholesale houses in the colonies draw their supplies through merchants on this side and we supply the merchants.

2710. I suppose you simply do not deal in those things that cannot be made in this country; you leave those to the merchants for them to get where they can ?—I have set out in Schedule 2 the amount that we ship short of what we would anticipate supplying were those colonial

Mr E. A. Webb.

13 Dec. 1904.

chemists at home. I have been very carefully through the books of my company to see whether we supplied the same proportion to those at home as to those abroad, and we do not. It is exactly the result that I expected; and that is all set out in Schedule 2.

2711. Let us take one thing, for instance phenacetin; you put down that as 15 per cent. short on the London house; what exactly does that mean?—It means that our business in London happens to be a convenient one for estimating this, because our export business and our home business are about equal. It means that we find that we have not shipped so much phenacetin to the chemists in the colonies as we have supplied to the chemists at home.

2712. On the Liverpool house I see it is as much as 60 per cent. short?—Yes. The reason for that is that their business is with South America, and they scarcely sell any of those things at all to South America. In the colonies the chemists are all Englishmen, and they have traditions and they buy from their English wholesale houses.

2713. (*Sir W. H. Holland.*) I suppose the suggestion is that the difference between 15 per cent. and 100 is supplied from foreign sources?—Yes, the retail chemist in the colonies would buy those things from the local house or else direct from Germany.

2714. (*Chairman.*) Does not this 15 per cent. short mean that for every 85 lbs. you have sent abroad, you ought to have sent 100 lbs?—Yes.

2715. (*Sir W. H. Holland.*) You still then get the bulk of it?—We get the bulk of it in that particular case.

2716. (*Chairman.*) Where do you get that phenacetin that you send the 85 lbs. of abroad; do you purchase that from Germany?—Yes, all those articles in Schedule I. are purchased from Germany.

2717. Then, in fact, you are to a certain extent shippers and buyers as well as manufacturers?—Certainly.

2718. (*Dr. Thorpe.*) I do not know that I quite understand this. I am not quite clear how you get at the per cent. Do you say that you ought to have shipped 100 lbs. of phenacetin and as a matter of fact you only shipped 85 lbs.?—Yes.

The inference drawn is that the balance of colonial supplies come from Germany.

2719. The inference being that that 15 per cent. has been bought directly or indirectly through a German house?—Yes, that has gone through a German house.

2720. It does not mean necessarily that the consumption of phenacetin in the country has become relatively less?—I do not know. We know that these articles are used in the colonies as much as they are used at home. A chemist in the colonies is more anxious to get any new chemical than our home chemists are—he always wants the latest thing out. Therefore we can tell from our experience that those things are as much in consumption in the colonies as they are at home.

2721. (*Mr. Nicholson.*) In this particular case the manufacturer in this country has not been affected at all; it is merely a question of commission to you on that 15 per cent. which has been lost?—Of course these things are not manufactured in this country.

2722. So, that, as I say, the loss from the national point of view is the commission on the 15 per cent. which you would have bought from Germany?—That is one of the losses, but it is not the entire loss, because the chemist in the colonies who will go direct for one article has to make up an order for other things as well. It gives the thin end of the wedge to German houses in our own colonies.

2723. You are justifying your position as a middleman in fact?—I am here to-day as a distributor.

2724. That is as a middleman?—That is so in these things.

2725. (*Chairman.*) You come here to-day, also as a producer and a manufacturer, do you not?—Yes, but I was asked to come here as a distributor.

2726. More as a distributor than as a manufacturer?—Although we are manufacturers, it was arranged that Mr. Umney should take that side of the question, and I thought I would take the other, so as not to be giving you the same evidence twice over.

2727. (*Dr. Thorpe.*) I am sorry to be a little dense about this, but I do want to get behind your second schedule. All these calculations surely are affected by considerations of demand at the place to which they are sent?—I have no doubt they are.

2728. You really cannot equate that or eliminate that from your consideration, can you?—I cannot say whether it is 44 per cent., or 45 per cent., or 50 per cent. We find that the shortage is very large, but I do mean to say that the percentage is accurately calculated within reasonable limits. You gentlemen have taken the smallest instance you can find in Schedule 2 except gallic acid, which, as a matter of fact, is the smallest. The others run—thymol 70 per cent., sulphonal 45 per cent., the salicylates 45 per cent., hydrokinone 53 per cent., cocaine 47 per cent., and so on. Those are very high figures.

2729. I think the Chairman took the 15 per cent. because it was in contrast with the 60 per cent. at Liverpool, and he wanted some explanation of why there was only 15 per cent. short in London when there was 60 per cent. short in Liverpool. Of course you have explained that; but I think that was the particular reason for the selection of the 15 per cent?—Yes, I understand that.

Preparations not requiring alcohol need not as a rule be purchased in Germany for export.

2730. (*Chairman.*) Having regard to your arrangement with Mr. Umney, I think we had better not ask you on questions of manufacture, although those are really the questions which interest us most. As a distributor, do you purchase in the German market any of the goods that you want to send to the Colonies, other than those goods which are not manufactured in this country? For instance, if you found you had got an order for a particular chemical not manufactured with alcohol, and that you could get it considerably cheaper in Germany than you could in England, you would buy it in Germany, would you not?—Yes. But might I just mention this interesting fact with regard to those things that we are obliged to go to Germany for—that there are very few of them into which alcohol does not enter.

2731. I am now asking you as regards the things into which alcohol does not enter. There are some of those probably which you might at times purchase in the German market rather than in the English market?—Certainly, as a matter of price.

2732. Does that happen often as regards goods into which alcohol does not enter?—No; I say those cases are few, excepting certain things where the main constituent is a product of that country.

2733. Is it rather in respect of particular things which you nearly always find are cheaper in the German market than in the English market, or is it according to the fluctuations of the market at different periods?—It is generally the same article that we go to Germany for; it is not so much governed by market fluctuations I should say.

2734. Can you name certain articles which, as a rule, you would probably get cheaper in the German market?—Permanganate of potash is one that we buy abroad. I do not know really why, but it is not made in this country.

2735. Then you have no choice?—No. I thought perhaps that was what you wanted to know.

2736. I am referring to the things which are made in this country and which are also made in Germany, into which alcohol does not enter, and where it is simply a question of price. Of course, if you manufactured them yourselves, you would send products of your own manufacture probably?—Yes.

2737. If you do not manufacture them yourselves, but some other English manufacturer does manufacture them, are there any of those things that you would generally purchase in the German market rather than in the English market?—No, certainly not.

2738. You could not name any?—I could not name any.

2739. (*Dr. Thorpe.*) About the permanganate of potash, which is an important article commercially, because it is used as a disinfectant on a fairly large scale, and it is an important manufacture. Why is that not made here?—That I could not tell you.

2740. It is a remarkable thing; alcohol is not concerned in that?—That is what I say. I quoted it as an instance where alcohol is not used.

2741. What is the commercial disadvantage in the manufacture of permanganate of potash here, whereby we cannot make it?—I cannot tell you. It is not within my knowledge.

2742. (*Chairman.*) Could you name any other things besides permanganate of potash that might be made in this country, but are not?—I do not think so.

2743. There are no other important articles?—No.

Loss of business, direct and indirect, owing to non-manufacture in United Kingdom of preparations requiring alcohol.

2744. I understand that you, as shippers of these things, find that the main mischief in regard to these alcoholically produced chemicals is not so much in the loss of the business in them as in the loss of business in other things that it leads to?—There is a loss both direct and indirect. It cuts both ways, certainly.

2745. Perhaps the indirect loss is even more important than the direct loss?—Yes, I should think it was.

2746. (*Mr. Tyrer.*) That is to say, where a buyer asks for one thing out of several, if he cannot get that one thing from you, that may determine, as I have known myself, the entire order going in another direction?—It means that he has to get, not only that article, but several others besides from the foreign country.

2747. In order to complete his shipment?—In order to make it worth his while to get the things over, because many of these things are sold in small quantities comparatively, not in large enough quantities to make a ton measurement for direct shipment.

Manufacture in United Kingdom with pure duty-free spirit suggested as best remedy for such loss.

2748. (*Chairman.*) It would be no help, of course, as regards people in the export trade to place a duty upon the import of these particular chemicals relatively to the amount of alcohol used in making them?—No, not unless we got a drawback.

2749. Even then that would not help you, would it?—No, it would not help us. Those articles must be made in this country in order to help us.

2750. (*Mr. Tyrer.*) You are speaking of drawback on exportation on the quantity used in the preparation?—Yes.

2751. (*Chairman.*) If by the aid of an import duty on the corresponding articles when imported from Germany into the home market, these things were manufactured in this country, that would not help you, would it, in your export trade, unless you got a drawback on the export of your own manufactures?—If those articles were made in this country from duty-free alcohol, that is what would help us, and very materially so, when exporting to places like South Africa, New Zealand and Canada, where there is a preferential duty. I should think that most likely the Germans would come over and start manufactories here, so that they might say that their goods were of British manufacture. We could recover our trade in those places at once, because of the preference given by South Africa, New Zealand and Canada.

2752. The preference is sufficiently important for that, is it?—It is 25 per cent. on the duty.

2753. (*Mr. Tyrer.*) In the case of Canada, is it not 33⅓ per cent.?—It is.

Anomalous working of Canadian preference in certain cases. (*See also* Qs. 2786-8)

2754. If there is anything of importance in this point, this also is important—that in Canada there is a difficulty notwithstanding the preference, because in order to retaliate, if you like to use that phrase, upon the United States, they have regarded the duty as being leviable upon the same amount as the selling price in the country of origin. Take sweet spirits of nitre exported under the condition of a drawback—with which nobody has any fault to find; when it got out there, the duty would be leviable on the price at which sweet spirits of nitre are sold in this country, which is somewhere in the neighbourhood of 2s. 6½d., is it not?—That is so.

2755. The consequence of that peculiar method of doing things has been to throw the preference and the sales entirely into German hands, because in Germany the selling price is at times something between 4½d. and 6d., and is now perhaps 6d. or 6½d., is it not?—Yes.

2756. And so in Canada they levy the duty on that price?—Yes. Although we are very large manufacturers of sweet spirits of nitre ourselves, we are obliged to buy for our Canadian house in Germany, so as to get it into Canada at a fair price. That is an anomaly which we are trying to get over by a petition through the Chamber of Commerce.

Tinctures. Satisfactory working of present system.

2757. (*Chairman.*) As regards tinctures, the present arrangements, as I understand, are perfectly satisfactory?—They are perfectly satisfactory. I should like to draw attention to the very large increase in the export. It has increased thirteen times in fourteen years.

2758. That you show in your Schedule No. 4?—Yes. We should anticipate similar increases with the other things, were facilities granted.

2759. What are the figures shown in your Schedule No. 4? Are they the exports of your firm?—No, they are the exports of the country. They are taken from published figures furnished to me.

2760. (*Dr. Thorpe.*) You will find them in the Annual Report of the Government Laboratory, will you not?—Probably. They are published somewhere. I have got here a great many more particulars than I have given you, showing the number of samples examined, and so on.

2761. Are you at all familiar with the actual conditions in Germany of the manufacture of those things?—No.

Special denaturants allowed in Germany for making chemicals.

2762. You say in your *précis* that Germany and other countries are able to make many chemicals which this country cannot make, owing to the facilities those foreign countries enjoy for the use of untaxed pure alcohol; do you know as a fact that they use pure alcohol—I mean undenatured alcohol?—I do not know that of my own knowledge, as I have not been there. Of course I have seen all the various evidence that has been brought forward, and I have read the regulations, which have appeared in print.

2763. May I ask what regulations you are referring to?—I am afraid my memory will not serve me exactly as to that.

2764. It is a fact that since 1903, when the law of 1902 came into operation, the Germans do not use pure alcohol for the manufacture of this class of products, but that they use a specially denatured alcohol; are you aware of that?—Yes, that I am aware of. That is exactly the facility we want in our own laboratory—to have the spirit denatured with one of the articles of manufacture.

2765. In asking for pure alcohol you are asking for something which your German competitors have not got?—No.

2766. Then do you want denatured alcohol?—We want either; we do not mind which.

2767. You are, of course, a large manufacturer of tinctures, which you export, and for which you get a drawback; I think as a matter of fact, you are one of the largest exporters of tinctures of this kind, are you not?—Quite possibly.

Tinctures. Question of manufacture in bond if duty-free spirit were allowed for other chemical preparations

2768. How do you imagine this proposal is going to work out in practice? You would not suggest abandoning the present method of manufacturing and getting drawback on your exportation, would you?—I am not quite sure that I understand your question, how it would work out. Are you talking about pure alcohol only, or about denatured alcohol?

2769. You ask to be entrusted with duty-free alcohol for the manufacture of certain products?—Yes.

2770. You use, as a matter of fact, a large quantity of duty-paid alcohol for the manufacture of tinctures?—Certainly.

2771. And you get a rebate on what you send out of the country?—Yes.

2772. How can you, in practice as a manufacturer, differentiate between the two classes of alcohol? What do you suggest in a practical way?—I have mentioned already that we are perfectly satisfied with the arrangements as regards tinctures, but if we were working entirely in bond with free alcohol, then it would seem to be a simple arrangement. We could have a separate part of our buildings as a bonded warehouse in which the manufacture was allowed, just as at present we have a separate bonded warehouse where the fortifying of lime juice is allowed, or where the making of perfumery is

Mr. E. A. Webb.

13 Dec. 1904.

allowed. It would be perfectly simple for us in Liverpool to have a separate warehouse, and as the different things were taken out of bond into stock, so they would pay the duty, whatever was the right and proper duty at the time.

2773. Do you wish that to include also the manufacture of tinctures?—If we were allowed to work with free alcohol we should ask you to allow us to make our tinctures with it, but, as I say, it is not an important point with us.

2774. What I want to get at from you, if I can, is, which would you prefer?—We should prefer to work with free alcohol.

2775. In bond?—In bond.

2776. (*Chairman.*) For the tinctures as well?—I do not say that all the wholesale druggists would—I think it is right to say that; but we should.

2777. (*Dr. Thorpe.*) I venture to think we shall have a considerable difference of opinion about that. We must have some general consensus of opinion and some general agreement on that. We cannot have one set of manufacturers making tinctures in bond, and another set of manufacturers making tinctures on another system. That would be extremely complicated?—It would be more satisfactory to work entirely in bond with pure alcohol. That is what we should prefer.

2778. (*Chairman.*) Even as regards the tinctures?—Yes.

2779. (*Dr. Thorpe.*) We must have one thing or the other; either you must look forward to a system of working in bond exclusively, or you must have the existing system?—It would not have occurred to me that that was necessary; but of course I do not know your difficulties.

2780. As a matter of Revenue control, it complicates the whole thing very much to have two systems, does it not?—Yes.

Caffeine. An instance of a successful industry resulting from removal of Revenue restrictions.

2781. You have quoted the case of caffeine, in which you say the arrangements have worked very satisfactorily, and you say that practically we have got there a trade which otherwise we should not have got. That is scarcely a case in point, is it, because there you are dealing with a material which otherwise would have been either burnt or destroyed in some way or sent out of the country?—What I wish to convey on that point is this—that before those facilities for making caffeine from tea which had not paid duty, we had to buy our caffeine entirely from Germany. Since those facilities have been given, we buy it entirely in England, and therefore we are not under the disability as regards caffeine that we are under as regards those articles in my schedule No. 1.

2782. The point really is that the caffeine arises from a material which is not tea from the point of view of the Customs, that is, not dutiable tea—I mean to say that it is made from stuff which is not to be allowed to go into consumption in this country?—The facilities we are given and, as I say, the effect upon my firm as distributors—which is the evidence I am giving—mean, that whereas we were at a disadvantage, now we are at an advantage.

2783. (*Mr. Tyrer.*) Owing to the action of the Customs Department in giving facilities for denaturing?—That is exactly it.

2784. (*Chairman.*) Is there much caffeine made now?—Yes, it is made in very large quantities when you consider the nature of the article. We sell 482 lb of it a year. That is a large quantity for a thing of that kind.

2785. (*Dr. Thorpe.*) I quite understand what you mean. You quoted this merely as an illustration showing how, when facilities are given, even in an article which would otherwise be worthless, a trade can be done with it if the Revenue authorities lend themselves to the establishment of such a trade. That is what you really mean, is it not?—If they take away our disabilities—that is so.

See Qs. 2754–6.

2786. (*Sir W. H. Holland.*) I do not quite understand how the purchase of goods in the German market would give you an easier access to the Canadian market, than you would get by purchase of English goods?—I took sweet spirits of nitre as an instance. Sweet spirits of nitre is very much cheaper in Germany than it is in England;

2787. But still, the effect of buying it in Germany would be that you would lose the 33⅓ per cent. preference?—Yes; but that is nothing compared with the difference in price, which is 2s. 6d. to about 6d.

2788. (*Mr. Tyrer.*) When I was in Canada, those were the two prices quoted and I called on the authorities; they seemed very sorry about it and tried to find a remedy?—I think the difference now is between 2s. 6d. and 5d. if I remember aright.

2789. Are you of opinion that the whole of the chemical preparations in your Schedule No. 1, with perhaps half-a-dozen exceptions, require alcohol in their preparation?—They all require it more or less. I thought it did not enter in the hydrokinone, but I am told it does. I am also told that vanillin is crystallized in pure alcohol. It is a little difficult for us to find out exactly what the manufacturing processes are in some of these things, because they do not come within our knowledge. Directly alcohol is required in any way, it is put out of the consideration of the English manufacturer.

2790. As a matter of fact, hydrokinone is not, and has not for a long time been crystallized with pure alcohol?—I put "probably" to hydrokinone and heliotropine because I was in doubt about them.

Synthetic perfumes.

2791. You have told us that you are an exporter of perfumes, and you have told us of your willingness, and desire, in fact, to manufacture perfumes in bond; you may, therefore, be treated as a perfume maker. May I ask whether you have bought, knowingly, synthetic perfumes of English manufacture?—Never.

2792. Have you ever had a list of synthetic perfumes presented to you by any English manufacturer?—It has not come under my notice.

2793. Do you think it likely that if there had been such products of English manufacture, it would have been so stated, in the belief that they would have had a preference on equal terms or anything like equal terms?—I think English manufacturers would have a preference on equal terms most certainly. We always give English goods a preference on equal terms.

2794. Have you ever heard of chloral hydrate being offered as of English make?—Never—absolutely never.

2795. You are very likely to have heard of it, considering the size of your firm?—We should be bound to have heard of it.

2796. It would have been almost impossible for you not to have heard of it?—Yes.

2797. (*Dr. Thorpe.*) I do not attach very much importance to the chloral hydrate, but you say it is not within your knowledge that any synthetic perfumes have been made by any English maker in this country?—I do not think they have.

2798. It would have been known to you that they really are made, would it?—Yes.

2799. (*Mr. Tyrer.*) Have you ever had a single synthetic perfume offered to you by J. W. Bush & Company—a name you know perfectly well, and whose goods you sometimes have ordered on indents?—It has never come to my knowledge; it has not come before me in any form.

2800. (*Dr. Thorpe.*) Would you mind telling us the price you pay for these synthetic perfumes you get from German houses?—I could not at the moment; I have looked up the price of everything else in my Schedule and I could tell you those; but I did not know that you would be asking questions about the synthetic perfumes. I could let you know.

2801. Are they not substances which command a relatively very high price?—Yes, I should say they do. But you must not ask me about them, because I have not come with a knowledge of the prices of the synthetic perfumes.

2802. Really the drift of my question is this—that they command such a high price that the value of the alcohol in that price is a comparatively small factor; but you are not able to answer me that?—No, I am not able to answer that.

2803. (*Mr. Tyrer.*) Is alcohol required for guiacol carbonate?—The price for that is now very much reduced, because the patent has expired within the last few days. I have found it a little difficult to ascertain whether alcohol is required in its manufacture.

Mr. E. A. Webb.

13 Dec. 1904.

TABLES HANDED IN BY MR. E. A. WEBB.

TABLE No. 1.

List of Articles made abroad for want of untaxed Alcohol for Industrial Purposes in this country, giving the consumption of such by some of the English Wholesale Druggists in 1903.

Name of Chemical.	Number of Wholesale Druggists making the return.	Weight of purchases in 1903.	Value at prices of November, 1904.	Remarks.
			£	
Acid Gallic	12	1,764 lb.	143	
Acid Tannic	13	5,498 lbs.	482	
Aconitine	7	16½ ozs.	24	
Antipyrin (Lion)	11	649 lbs. 8 ozs.	425	Hamburg exported in 1903, £28,900.
Atropine and Salts	12	430 ozs.	301	
Butyric Ether	6	575¼ lbs.	136	Total average importations of last three years into England, =4,870 lbs. v. Schedule 3.
Cantharidin	8	11 ozs. 12 grs.	41	
Chloral Hydrate	12	6,197 lbs.	1,134	Total average importations of last three years into England, =25,376 lbs v. Schedule 3.
Cocaine Hydrochlor	13	9,956 ozs.	6,148	
Eserine and Salts	12	1.005 grs.	151	
Guaiacol Carb.	13	665¼ lb.	1,676	Estimated at Export price, =£443 only.
Heliotropine	8	32 lbs. 6 ozs.	12	
Hydrokinone	11	933¾ lbs.	152	
Paraldehyde	12	3,953 lbs.	312	
Phenacetin	13	6,910 lbs.	806	
Phenazone B.P.	13	4,263 lbs.	1,347	
Pilocarpine and Salts	10	90 ozs.	117	
Salicylates	13	41,402 lbs.	2,070	Hamburg exported in 1903, £47,250.
Santonine	11	1,484¼ lbs.	2,020	
Sulphonal	13	2,025 lbs.	337	
Thymol	11	549 lbs.	137	
Vanillin	9	99 lbs. 14 ozs.	96	Hamburg exported in 1903, £25,250.
		TOTAL	£18,067	

TABLE No. 2.

Showing how much per cent. less of the following Chemicals are shipped by my Company for Export than for Home Trade.

Article.	Per cent. short London House.	Per cent. short Liverpool House.
	Per cent.	Per cent.
*Acid Gallic	14	93
*Acid Tannic	26	27
*Chloral Hydrate	44	44
Cocaine	47	67
*Guaicol Carb.	46	9
Hydrokinone	53	97
Phenazone	39	55
Phenacetin	15	60
Salicylates	45	37
*Santonine	30	
Sulphonal	45	69
Thymol	70	

Practically none of the above are shipped by my Company to South America and none of those marked * are shipped to Australia.

Mr. E. A. Webb.

13 Dec. 1904.

TABLE No. 3.

Statement of the Imports and Re-exports of Butyric Ether and Chloral Hydrate during the three years 1901-1903.

Imports.

Year.	Butyric Ether.			Chloral Hydrate.	
	Quantity.		Value.	Quantity.	Value.
	Gallons.	lbs.	£	lbs.	£
1901 - - -	441	(= 3,858)	397	35,972	3,999
1902 - - -	647	(= 5,661)	471	17,258	2,069
1903 - - -	582	(= 5,012)	526	22,899	2,601
Re-exports.					
1901 - - -	4	(= 35)	5	7,724	755
1902 - - -	17	(= 148)	18	3,688	361
1903 - - -	17	(= 148)	10	3,483	368

(Signed) A. J. WOOD,
Principal.

Statistical Office,
Custom House, London.
29th November, 1904.

TABLE No. 4.

Showing the Increase in Shipments of Spirituous Preparations in Bond when facilities were given under the Drawback System.

Year ending March 31st.	Spirituous Preparations exported in Proof Gallons. England and Scotland.
1889 (3 months) - - - -	1,506
1890 - - - - - -	9,715
1891 - - - - - -	13,032
1892 - - - - - -	20,895
1893 - - - - - -	27,433
1894 - - - - - -	42,008
1895 - - - - - -	38,876
1896 - - - - - -	56,463
1897 - - - - - -	56,999
1898 - - - - - -	67,520
1899 - - - - - -	78,892
1900 - - - - - -	80,726
1901 - - - - - -	95,543
1902 - - - - - -	109,396
1903 - - - - - -	118,557
1904 - - - - - -	121,137

Mr. JOHN CHARLES UMNEY, called; and Examined.

Mr. J. C. Umney.

13 Dec. 1904.

2804. (*Chairman.*) I understand you come on behalf of the London Chamber of Commerce ?—Yes.

2805. Do you wish to give evidence as a manufacturing pharmacist ?—Yes.

2806. Mr. Webb, who has just been in the box, told us that he came as a distributor rather than as a manufacturer, and for questions relating to manufacture he referred us to you. What is the name of your firm ?—Wright, Layman & Umney, Limited.

2807. In London ?—Yes.

2808. Are you manufacturers of chemicals of all sorts ?—Not of chemicals principally, but of pharmaceutical preparations and pharmaceutical extracts.

2809. Do you deal in tinctures ?—Yes.

2810. As regards that part of your business, I presume you are quite satisfied with the present arrangements ?—I think so; I think they are fairly satisfactory.

Pharmaceutical products containing alcohol radical.

2811. Where you are really affected, I take it, is in such things as phenacetin and other articles into the composition of which the alcohol radical enters ?—Yes, partially those.

2812. Those are the most important, are they not ?—In point of money volume of trade, I should think perhaps that might be said to be so.

2813. And it is in those that the objections to the use of methylated spirit are strongest ?—Yes, I take it that that is so.

2814. As regards phenacetin, you state in your *précis* that duty on the spirit would come to £141 on £100 worth of the article as imported ?—At the present time I am informed by those who have the opportunity of making it, that that is so.

2815. So far as you know, it is not made at all in this country ?—I think not; I have no knowledge of it at any rate.

2816. There are many other things in the same position, such as sulphonal, and so on; are there not?—Yes.

Finance Act, 1902. Deterrent effect of cost of conditions imposed by Revenue.

2817. You have considered, I believe, whether under the Act of 1902 it would be possible for you to undertake the manufacture of these pharmaceutical preparations?—I did apply on behalf of my firm for permission to manufacture certain vegetable alkaloids; but the conditions were a little difficult to comply with, and would have involved a great amount of expense, so I did not think it was really worth while going any further—I mean, not for one single wholesale druggist.

2818. Do you mean that you did not go further than studying the regulations, and that then you came to the conclusion that it would not answer your purpose?—Having a knowledge fairly well of what one might expect as a yield, and of approximately what it would cost, and simply being in the position of selling as wholesale druggists to the retail pharmacists of this country, and not as one wholesale druggist to another—I do not suppose other wholesale druggists would buy of us—I thought it would not be possible to sell such quantities of such things as atropine and so on as to make it really remunerative.

2819. Under what circumstances would it be possible do you think? Taking the regulations as you know them under the Act of 1902, what were the particular points which made you disinclined to undertake the work?—The setting aside of a separate building for the purpose, or of a portion of a building, and the cost of the supervision. The attendance of the officer at certain times would probably involve a great deal of expense.

2820. Something of that kind seems imperative, does it not, if you are dealing with a great many other substances besides into which duty-paid spirit has to enter, such as tinctures?—In the case of the tinctures, of course, it does not apply. We sell them with the alcohol contained in them.

2821. You could not carry on, in one and the same building, two operations, one with duty-paid alcohol and the other with duty-free alcohol, because then there would be no possibility of separating them?—No, you could not do that; and therefore one must have a sufficient volume of business to warrant the expense of a separate building in the case of those articles made with duty-free alcohol in some form or other.

Suggestion of co-operative working in bond.

2822. Mr. Webb put before us a considerable list of articles into the manufacture of which alcohol enters, such as antipyrine, heliotropine, vanillin, and so on—those of which there seems to be the largest quantities are antipyrine, chloral hydrate, the salicylates, and vanillin. Have you thought further about the matter since you made the application to us, in order to see whether it might be possible or whether it might be profitable for you now to undertake the manufacture, if suitable arrangements could be made, in a separate building?—I am not really prepared to say that it would answer the purpose of one wholesale druggist in the ordinary way of business to go to that expense—that is to say, speaking of the wholesale druggist as having an outlet for his products only among his own customers, the retail pharmacists here and abroad.

2823. Have you considered at all whether it might be done by a combination of wholesale druggists?—I think it probably could be done quite easily in that way.

2824. You would not see any great difficulty or objection about it?—I do not think there would be any difficulty.

2825 Supposing for a moment that there was such a combination formed of wholesale druggists, who were willing to put together the necessary capital to provide a bonded factory for articles which cannot be manufactured without spirit, and for which they must have pure spirit; would there be any serious difficulty in protecting the spirit from abstraction, do you think?—I do not think so.

2826. Would it be possible to denature the spirit suitably for each particular article that was to be manufactured?—I think it would be in the case of those where the simple extraction of a drug was required in the first instance, or in the case of some process where the alcohol did not remain in the finished drug.

Methylated spirit. Its cost the main objection to its use.

2827. I see you say in your *précis* as regards the objections to the use of methylated spirit, that while for certain things the methylated spirit is or may be unsuitable and detrimental in character, so far as your experience goes, the main objection and the most serious objection to the use of methylated spirit is on the ground of its cost?—Yes, it has hitherto been so.

2828. What would you put as the difference in cost between methylated spirit and pure spirit?—Normally I should put it at about 5d. per gallon, taking the same relative strengths of about 63 over proof.

2829. Would that be a serious item of expense in the production of these things?—In the production of such articles as the wholesale manufacturing pharmacist handles it would mean a difference of 3 per cent., 4 per cent., or 5 per cent., according to the relative values of the drugs and the product.

Chances of meeting German competition with use of duty-free alcohol discussed.

2830. Supposing you establish a manufacture in bond with pure duty-free spirit, do you think that you would have a reasonable chance of being able to compete in price with a German manufacture which is already established?—In the case of the alkaloids, I do not think there would be any difficulty at all. The majority of those houses which are now making them in Germany and other countries are of course powerful houses with large capitals, and might possibly sell their goods at very low prices—below cost price perhaps—during the time that we were engaged in building up a trade or an industry in those articles. But, so far as one can calculate, and so far as one can see, there appear to be very big margins between the actual values of them and the lowest rates at which they are sold. Those rates are in almost every instance Convention rates—that is to say the prices are maintained artificially.

2831. Under competition from this country, they might cease to maintain those high prices?—I think so, probably.

2832. Therefore if you were making a calculation as to whether it would be profitable or not to start this industry, you must not take the existing prices as your basis?—No.

2833. You would have to allow a considerable margin?—Yes

2834. (*Dr. Thorpe.*) These Convention prices exist amongst those who are engaged in the manufacture of a very large variety of things, and therefore the persons who are in the Convention can make certain things pay for those others which they may have to sell under cost price?—Yes, of course, as soon as they get a competitor outside their so-called Conventions, they either reduce their prices to such an extent that it does not answer his purpose to compete—that is generally the first process—or else they take him into the Convention. If he is only a small manufacturer, then he ceases to make it.

2835. Assuming that your co-operative concern were established, and that there was practically a Convention here, you would have to fight that Convention very much with their own weapons, would you not?—It depends whether a duty were placed on those products to prevent them coming into this country, assuming alcohol had been used in the manufacture of them. We should only desire to be on an absolute equality; and I think, being on an absolute equality, we should be in precisely as good a position as they are, for in the majority of instances the drugs from which these alkaloids are made come, in the first instance, into this country, and are then exported from this country to Germany or other countries where the alkaloids are made.

2836. You are talking of things into the preparation of which alcohol enters?—Yes.

2837. In so far as the German persons in the Convention get subsidised alcohol—that is to say, in so far as they get in many cases alcohol below the cost price of production—how are you going to fight them, unless you get alcohol on the same terms?—Supposing we had an arrangement for working with alcohol free of duty in this country, or under certain conditions, we should not allow to come into this country, I presume, goods that had been made with subsidised alcohol—I mean we should not allow them to come in unless on an equality.

2838. (*Chairman.*) How can we stop it, unless we have another Convention like the Sugar Convention?—That is so. If they are really using subsidised alcohol to make these alkaloids, then the profit is very much greater still than we had imagined it to be.

Mr. J. C. Umney.

13 Dec. 1904.

2839. I think subsidised alcohol means that it is sold somewhat below cost price ?—Yes—that there is a certain allowance.

Tinctures. Successful English competion under present system.

2840. (*Dr. Thorpe.*) Anyhow, it is alcohol at a price that you cannot hope to get it at by the present arrangements of trade here ?—In those instances where we have had absolute equality, I do not think that the wholesale druggist or manufacturing pharmacist in this country has shown himself unable to compete with those of any other country in the world, including Germany. When we have had equality, we will say, for the sake of argument, in tinctures, we have shown ourselves quite able to compete in all the markets of the world ; and I do not see why we should not compete, given that we had absolutely equal conditions, in anything else ; of course to a person accustomed to make alkaloids, tinctures might be difficult to make, and to a person accustomed to make tinctures, alkaloids might be equally difficult to make.

2841. (*Chairman.*) It would be very much on a level with the tinctures, because, as regards the tinctures, you now have to make them with duty-paid spirit, but you get repaid the duty ; yet in that case you have still borne any extra cost there may have been as regards the alcohol, and have competed with your German competitor in the foreign or colonial markets, or, at any rate, in neutral markets. Therefore, as I understand your argument, your position here would be very much the same, because if you can do that with the tinctures, there is no reason why you should not do it with these other pharmaceutical products ?—That is so. In the exportation of tinctures we have a uniform allowance for waste of 3 per cent.

Allowance on export for waste.

2842. (*Mr. Tyrer.*) Do you get the whole duty returned, including the surtax ?—Yes, including the surtax. The allowance for waste, 3 per cent., is an average, and there are, of course, a great many preparations in which that looks too great an average, because there is practically no waste. I do not know of any market in the world in which we are not able to compete in tinctures.

2843. (*Chairman.*) So far that is encouraging ?—Yes.

2844. (*Sir W. H. Holland.*) You do not suggest a smaller allowance for waste, do you ?—As an average we have found that it is accurate.

2845. (*Mr. Tyrer.*) Was it not 4 per cent. at one time ? —It was 4 per cent. in certain instances and 2 per cent. in certain other instances. That led to a great deal of trouble, and so it was made an average of 3 per cent.

2846. As the result of a very important series of consultations ?—Yes.

Special denaturants for making pharmaceutical products Variety required.

2847. (*Chairman.*) You suggest in your *précis* as regards special methods of denaturing the use of " powdered galls for the preparation of tannin and other denaturing agents on similar lines, that is to say one of the chemical principals or drugs extracted from, or operated on in the manufacturing process." Assuming that you were manufacturing in bond, it might still be desirable to apply some of those denaturing processes ; would there not then be a difficulty, owing to the number and variety of the things that probably would be manufactured ?—I do not think so. I do not think the number of articles for manufacture would be very great. Probably it could be arranged that there should be a series of denaturants, and not necessarily a different one for every separate product.

2848. You could group them, do you think ?—I think they could be grouped.

The German denaturants.

2849. (*Dr. Thorpe.*) Are you aware of what is used in Germany ? You do not suppose, do you, that pure alcohol is used for the manufacture of these things in Germany ?—I know that various denaturants are used.

2850. Would the articles which are used in Germany suit you ?—I think in some instances they would—both in France and Germany, so far as I have been able to gather from the regulations.

2851. There are four in number, for example, in use in Germany which are applicable to all the kinds of manufactures that you are speaking of, I mean the manufacture of fine chemicals. They are pyridine bases, benzol, turpentine, and animal oil. None of these things are ancillary to the manufacture of anything which you make : they are not, for example, of the nature of galls, which you suggest for the preparation of tannin. You are putting before us that your general principle would be to take something which is ancillary to the manufacture, or which takes part in the manufacture ; but none of the denaturants which are used in Germany for the manufacture of precisely similar articles plays any part whatever in the manufacture ?—That is so ; but particular ones are used in France of course. Powdered galls, for instance are used in the manufacture of tannic acid.

Prospects of competing with Germany if special denaturants were allowed.

2852. Supposing we found we could not do that, but copied the German system—we might enlarge the list, for probably there would be no objection to having half-a-dozen instead of four ; would you see any objection to that ?—I do not think there would be any great objection until one got to the stage of crystallizing alkaloids, but not for extraction purposes.

2853. In other words, if you were put into the same position as the Germans are, you think you ought to be satisfied ?—I think we could make things equally well and at competitive prices.

2854. We shall know exactly what the Germans do and in fuller detail, so as to see what is necessary to put you into the same position as the persons who are your more serious competitors ?—I think it would answer the purpose admirably, if you could put us into the same position as the Germans.

2855. (*Mr. Tyrer.*) A question has been asked as to a denaturant ; supposing that alcohol denatured with pyridine were used in the preparation of one of these alkaloids, I take it you would be able to remove the pyridine, that is to say, you would be able to produce a product which would not be affected by the pyridine ?—Up to the stages where one had to actually free the alkaloid from solution in ether, or whatever it might be ; but when one comes to the recrystallizing stages I do not know, because pyridine is a body which clings very fast to anything, and it is very difficult to remove the odour of pyridine. Of course, under certain conditions of neutralization it might be done.

2856. When the preliminary experiments on tinctures were being made as to the determination of waste and so on, was not the laboratory at your works placed at the disposal of the officers of the Inland Revenue ?—Yes.

2857. And they themselves made actual experiments there ?—Yes.

2858. There would be no objection, I presume, in the case of the development of these substances which are interesting to you as manufacturing pharmacists, being treated in the same way, and experiments being made on a more or less large scale, so that the inland revenue officers might see what was done and form a just estimate of the waste ?—No ; we could place one of our buildings at their disposal. I think we could arrange to do it quite easily. We could lock up one of the buildings actually for the experiments.

Choral hydrate.

2859. (*Dr. Thorpe.*) Have you any experience yourselves of the manufacture of chloral hydrate ?—No, I was not aware that any was made in this country at all. My father told me that some, I do not know how many, years ago—thirty-five years ago I think—he once made some experiments in the making of chloral.

2860. Thirty-five years ago chloral hydrate was rather more of a chemical curiosity than a medicament ?—That is about the time he told me.

2861. That was about the time that Liebreich discovered its virtues ?—Then it must have been about thirty years ago.

2862. You have yourself no experience of the manufacture of chloral hydrate ?—No.

Suggestion that methylated spirit should be cheapened by reducing quantity of wood naptha used.

2863. I see in your *précis* you submit a suggestion that possibly the amount of the methylating substance, the wood naphtha itself, might be very considerably reduced, and you suggest 2½ per cent. as against the present 10 per cent. ?—Yes.

2864. I think you put that rather too low. It is a matter for consideration whether, at all events for traders

like yourselves, who have to use the substance under supervision, we could not do with less—I say this without prejudice; but it is quite arguable and worthy of consideration whether less than 10 per cent. might be used. But I venture to say that 2½ per cent. without some other indicative denaturing substance would be too small; indeed in this case you are asking for something which no other country grants. Even in Germany, where so small a quantity of wood naphtha as 2½ per cent. is occasionally used, it is always accompanied by some other substance?—Of course, I was thinking rather of cost.

2865. I quite see that, and I sympathise with that point of view. You set in the very forefront of your case that the real factor in this matter is the cost?—Normally, it is the cost.

2866. That is a plain straightforword way of putting it, and we all recognise it. You wish, therefore, to minimise this cost as far as you can, and we are all in agreement with you. However, your suggestion that the cost of the methylating materials should be actually one-fourth of what it is, is pushing that a little further than we, I think, could accept, unless you are content to recognise the desirability that something else should be added. It may be something which will not materially alter the price, such for instance, as a minute fraction of animal oil, or something of that kind, but which will serve the purpose as well as an increased quantity of methylated spirit?—I am afraid animal oil would not answer in the case of any vegetable extracts, I am afraid that the difficulty of getting rid of any animal oil, that is the final dissipation of it, would be very great—I am judging from my handling of it.

Animal oil as a denaturant.

2867. Where you have to use denatured alcohol in the preparation of a thing—apart, I mean, from the mere crystallisation of it—that is as an actual integral part of the thing, you might have your partially denatured methylated spirit; and you might have a normal methylated spirit for the purpose of crystallisation wherever it was possible. That is one way of meeting the difficulty?—Yes.

Alcohol for crystallization.

2868. And in that case you recover practically the whole of the spirit?—Yes.

Practically the whole recovered.

2869. Therefore, you are put to no very large cost there?—No.

2870. Even the first cost is not a very considerable matter, and the fact that you recover it all again—for you would in any case recover whatever alcohol you used, because you would have to subject it to distillation?—Yes.

2871. Therefore, putting that cost aside, whatever was the character of the alcohol, you could not be put to any great disadvantage under those circumstances?—That is so.

2872. How is the process of recovery to be protected?—I take it that could be protected quite as easily as the actual storage of the alcohol.

Protection of the recovered spirit.

2873. In the actual storage the alcohol is under, or may be under, a revenue lock?—The receiver and the still could be under a revenue lock.

2874. Do you contemplate actual arrangements such, for example as a distillery has—all those complicated arrangements for the recovery of the alcohol—in connection with your comparatively small operation?—As applied to our small operations, and where one person only carries them on, as I said in the first instance I am afraid expense would be prohibitive. But having got to rather a higher stage, and having set a building apart for it, the revenue officer could lock it, and then he might leave it for two or three days. I have been into some of the big distilleries in Germany—not distilleries for spirituous distillation; I am speaking now of some of the big distilleries in Germany where they distil spices, subject to drawback, for the volatile oils. There the Customs officers see the stills charged, lock them and then leave them. They get out a certain proportion of the volatile oil, and an allowance is made for the spices that have ben used.

2875. What volume of material is being worked upon, do you imagine under those conditions?—Sometimes very large quantities—perhaps a ton at a time.

2876. I am thinking of your preparation of a few kilogrammes or a few pounds—for that is what you do; it is only a question of a few pounds?—Yes.

2877. (*Mr. Tyrer.*) Does not the difficulty disappear now, under the new Act?—When I made application for the manufacture of atropine, one of the first statements that was sent to me in print was that I had to prove the magnitude of the industry—I mean that it was to be something of a certain size In this particular case, I take it, that a combination of wholesale druggists in this country would be an industry of a certain size; whilst on a single trader applying, you would be able to say to him, "This is not an industry of a certain size; if you want to join an industry of a certain size, there you are, you must throw in your lot with those people."

Attitude of the Board of Inland Revenue to individual traders explained.

2878. (*Chairman.*) It would not happen like that. Supposing we determined that a particular class of manufacture was a manufacture of sufficient importance to be given the advantage of the Act of 1902, we should give that advantage to everybody who did that manufacture, subject to this, that they would have to submit to the regulations. Those regulations would be much too expensive for a single individual acting by himself, and therefore it would be for him to determine whether he would go into the combination. We should not say to him, "You must go into this combination in order to be allowed to do it;" we should simply say, "If you can comply with those conditions you can have the advantage of the Act." Once we said it to one man we should have to say it to everybody else. The practical check comes when the man who is only going to do it on a very small scale says, "If I have to pay for a Revenue officer here all day or all night, or at any rate for pretty constant attendance, it will cost me so much, and I cannot possibly do it;" so he drops it in that way, unless he can come in to a sort of combination?—We say that individually now—that we are not able to comply with those conditions of having an industry of sufficient magnitude; but if we were joined together—and certain of us might be prepared to join together, I mean those of us who work together now, and who are more or less associated—that would be then an industry of a sufficient size.

2879. It need not be in one place only?—No.

2880. Anybody who thinks it worth while to pay for the supervision would probably get our consent?—Yes. Of course, I have no warrant for saying this.

2881. In your *precis* you refer to the Merchandise Marks Act, but I do not quite follow you there. You say, "It may be argued in many instances that this disability is not the result of the absence of the unfettered use of alcohol, but rather of defective Patent legislation, and the working of the Merchandise Marks Act." How does the Merchandise Act Marks come in?—There are many instances where we have to send goods to foreign countries, and especially to our own Colonies, where we have of necessity to mark them "Made in Germany." We have to leave the marks on them—"Made in France, Made in Germany, Made in the United States," and so on. That has actually indicated to the persons buying from us the origin of those goods.

Merchandise Marks Act, Its operation in cases where goods are bought abroad for export.

2882. (*Dr. Thorpe*). Will you go on with the paragraph? You say further, "But it must be obvious that those laboratories having facilities for working with untaxed alcohol in large industries such as aniline dyes, are able to expend considerable sums in research on medicinal substances and the conduct of therapeutic tests with the same." I do not quite see the relevance of that?—The large aniline dye factories in Germany, having immense capital, and having a lot of people working on various chemical problems, are naturally able to put aside a certain amount of money every year for research work of different kinds. It does not matter whether it pays or whether it does not—that is a comparatively small thing. It is for that reason that practically all the synthetic chemicals that have been discovered in Germany have been discovered in those laboratories.

Research work in German aniline dye works, and its results in discovery of new chemical products. Has this any connection with the alcohol question?

2883. That has nothing to do with the alcohol question, has it?—It is not actually dependent on it, as it stands; but it is a result of it.

2884. No; these people have been set to research, not because they have alcohol or anything to do with alcohol, but because they are there for research?—But having the power to use alcohol, and so to create a trade in the country by sending those products into a country where there is taxed alcohol, they have got immense profits which they would not have had in fair competition.

Mr. J. C. Umney.
13 Dec. 1904.

2885. That assumes that alcohol is concerned with those things, which is not necessarily the fact ?—I do not think it assumes that. I think it assumes this—that those large factories have been able to make immense profits; that they have accordingly been able to set aside certain amounts for research (which they have done again and again), and that they are thus able to make researches in substances not necessarily containing ethyl or methyl alcohol, but various substances which may be of service in medicine, which they would not have been able to have made research in, if they had not had those big businesses.

2886. May I point out to you that you are begging the whole question ? How have they made those enormous sums—not by virtue of the alcohol or of any facility in getting alcohol. The aniline dyes are not dependent upon alcohol, are they ?—Not all of them, of course.

2887. Only a very small fraction of them ?—Of course, I am not an expert in aniline dyes.

2888. This is what is in your mind: You say, "Evidently these aniline people, having the facility for using large quantities of alcohol have made enormous profits by the manufacture of aniline dyes, and therefore, they can set aside a certain sum of money for research" ?—Let me put it in another way. Almost every synthetic chemical that has been introduced into medicine has come from the laboratories of those houses that are the principal manufacturers of aniline dyes. That is a coincidence, if you like.

2889. It has nothing to do with alcohol ?—Then it is a coincidence that wants explanation.

2890. (*Sir W. H. Holland.*) There are no limitations on their field of research ?—Quite so. They have immense businesses, and they can devote one department to it; just as one might have a huge store in London, which need not pay in a particular department. because the others will pay for it.

2891. (*Dr. Thorpe.*) My point is that that has nothing whatever to do with alcohol ?—I say that those substances come from those huge houses which curiously enough are engaged in the manufacture of aniline dyes, where it does not matter much whether they sink a little money here or there.

2892. That is true, but it has nothing to do with alcohol ?—It comes from those establishments; that is what I am stating.

TENTH DAY.

Wednesday, 14th December, 1904.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair*).

Professor Sir WILLIAM CROOKES, F.R.S.
Sir W. H. HOLLAND, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. W. SOMERVILLE.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*).

Mr. WALTER FRANCIS REID, called; and Examined.

Mr. W. F. Reid.
14 Dec. 1904.

2893. (*Chairman.*) You are one of the witnesses deputed by the London Chamber of Commerce, I think ?—Yes.

2894. You are a technical and consulting chemist ?—I am.

Nitro-cellulose Powders. Methylated spirit not considered suitable. (*See* also Qs. 3000-19.)

2895. Are you connected with any particular firms or businesses ?—I am connected with no particular firms.

2896. In your *précis* the first subject you deal with is explosives. We have had a considerable amount of evidence upon that, and therefore I think I need not ask you a very great many questions upon it. We have had fully explained to us the way in which spirit is used in explosives. I see that you, like other witnesses whom we have had before us, consider that methylated spirit is not suitable ?—That is so. I have not found it so suitable as the pure spirit.

2897. Have you positive evidence on that point, or only the negative evidence that it has not been proved to be suitable ?—I have the positive evidence that the explosive produced by the help of methylated spirit is not so good as regards the heat test, and not so regular as regards the ballistic properties.

2898. Then you are acquainted with the experiments that have been made with the use of methylated spirits in connection with these explosives, or you yourself have made such experiments ?—Certainly. I am the originator of the industry. I have gone into it very extensively.

2899. You have tried it with methylated spirit ?—Yes. I may say that it was of very great importance in 1881 and 1882 to be able to cheapen the use of the solvent, because otherwise one could not compete with the black powder at all.

2900. Of course on the score of cost there is no question that methylated spirit is not as advantageous to the manufacturer as pure spirit, because it is distinctly dearer ?—Yes, that is so.

The future of nitro-cellulose powders.

2901. Have you any views as to whether the nitro-cellulose powders are likely to prevail over the other smokeless powders in future, in preference, that is, to the nitro-glycerine powders ?—I think that it is almost impossible that you will get a nitro-glycerine powder that would not have too great an erosive effect upon the barrel of the gun. We ourselves in England have come back from a high percentage of nitro-glycerine to a lower one, and the continental countries are adopting chiefly nitro-cellulose powders.

2902. It is a point that is a good deal discussed still amongst experts, is it not ?—Certainly. If one could find a means of toning down the great erosive effect of nitro-glycerine upon the barrel of the gun, then it might possibly be used, but so far as I am aware no means have been found at present.

2903. Do you act as consulting chemist to any explosive manufactory ?—Yes, to several.

Excise supervision with duty-free spirit.

2904. As regards the question of supervision; if pure alcohol were used, we have had evidence which shows that probably there is no form of factory in which control over the pure alcohol would be so easy as in an explosive factory ?—I know of none. One is obliged in the first instance to choose men for the work who are sober, so that quite apart from any supervision that may be exercised the class of workmen is a superior class as regards temperance.

Fulminate of mercury; manufacture under Finance Act, 1902.

2905-6. Then you refer to fulminate of mercury; you are aware, I daresay, that at Nobel's factory they are now allowed to use pure spirit ?—Yes, I am aware of that.

2907. Do you happen to know whether they are satisfied ?—I could not say that. I do not think myself, speaking generally, that any explosive manufacturer that was put on the same terms as regards the manufacture of fulminate of mercury as his competitors in Germany would have any reasonable cause for complaint. The only cause he would have for complaint then from the commercial point of view, would be the necessary extra cost of spirit in this country.

2908. At present they are on an equal footing except in that respect, and in respect of having to pay something for the supervision ?—Yes, that is so. I believe the supervision has been very much relaxed in Germany in explosive factories since the precautions which were taken in the first instance to prevent fraud.

Xylonite.

2909. Passing from the explosive industry, in that of celluloid there is only one large factory; in fact, I believe there is only one factory—for making celluloid in this country, namely, that of the Xylonite Company ?—Yes.

2910. They are now employing duty-free pure spirit ?—Yes, I believe that industry has been assisted.

Artificial silk. Methylated spirit found unsuitable.

2911. Then you refer to the manufacture of artificial silk; were you associated with the attempt to start that at Coventry a few years ago ?—Not with that one, but previously I was consulted in the matter. I may say that I made artificial silk very many years ago—more than twenty years ago—from an experimental point of view.

2912. Would you tell the Committee what point the attempt that you were associated with reached; did they get to the point of actually attempting to manufacture ?—We felt that it was hopeless to commence it in this country.

2913. For what reason ?—We found, as I knew already from my experiments with smokeless powders, that we could not get a pure white product with the help of methylated spirit, and that under those circumstances we could not compete with the ordinary silk.

2914. At what period was that ?—At the beginning of the eighties.

2915. As long ago as that ?—Yes.

2916. Then it was more a question of the colour, was it—or was it a question of the strength of the fibre ?—Both. After the nitro-cellulose has been treated with methylated spirit—of course I use the term "methylated spirit" with the knowledge that it is not a definite term at all, and that it depends upon the wood alcohol that is used for methylating—I found with all the methylated spirit that I had then, as I have always found when I have since made further experiments in the matter, that that had a deleterious effect upon the nitro-cellulose.

The Coventry enterprise. (*See also* Qs. 2969–74.)

2917. You refer in your *précis* to an English factory that was erected and had failed. That, I suppose, is the one that was erected at Coventry some short time ago ?—Yes.

2918. But you yourself were not connected with it ?—No, I was not personally connected with it.

2919. As you have mentioned it, have you had information given you upon that particular attempt ?—Yes, There was a paper read before the Society of Arts by Mr. Cash; I took part in the discussion there, and I obtained a good deal of information otherwise. I have been interested in the subject for many years, and I have been consulted by different factories who thought that perhaps they might introduce the manufacture. I have also naturally had an interest in what they have been doing on the Continent, and I had an opportunity at St. Louis of getting figures and definite statements about the way the industry has progressed on the Continent.

The non-alcoholic process.

2920. There is one patent for the manufacture of artificial silk which does not require the use of alcohol, is there not ?—There are two or three. The one which is being used on a large scale depends, I believe, on the use of cupro-ammonia. That is used at the Glanzstoff-Fabriken Aktien-Gesellschaft.

2921. Do you happen to know whether the use of that method is increasing ?—Very largely. It is very remunerative. I have got their financial figures. I think in four years they paid 58 per cent. in dividends, they wrote off for plant 36 per cent. and they put to reserve about 56 per cent.

2922. That was a non-alcoholic process ?—Yes; but the alcoholic people are doing equally well. Although they have not published their figures, they are doing very well indeed.

2923. Would there be any reason to suppose that the non-alcoholic process is likely to supersede the other ?—I do not think it has such great advantages as are claimed for it, because although the material that they use is cheap, the processes are troublesome I believe.

2924. (*Dr. Thorpe.*) Is the basis of the new process pyroxyline ?—No, the basis of the new one is cellulose. They absolutely get the cellulose, but when they have got it, it is more inflammable than the other process in which they use nitro-cellulose. I have samples of all those kinds, but I have not brought them with me, as I did not think it would interest the Committee to see them.

2925. (*Chairman.*) As regards that particular process there is nothing, unless there may happen to be patent rights, to prevent it being adopted in this country at the present time, is there ?—No, I do not think there is.

2926. (*Sir William Crookes.*) Do I understand you to say that the cupro-ammonia process in which cellulose is used is more inflammable than the process in which nitro-cellulose is used ?—Yes, that is so; the denitrated thread does not burn so readily.

2927. Is it denitrated afterwards ?—No, it is never denitrated with the cupro-ammonia process.

2928. It is with the other ?—Yes, and the denitrated cellulose is less combustible than the original cellulose in the form of cotton.

St. Louis Exhibition. French and German exhibits of chemical prdouots derived from ethyl alcohol.

2929. (*Chairman.*) You state in your *précis* that at the St. Louis Exhibition both France and Germany showed many articles that could not be produced by our manufacturers under existing conditions; would you name one or two of the principal ones ?—I did not at the time I was there know that I was going to give evidence here, so of course I could not take notes; but I have a catalogue of the German exhibits here, and I could give you the number of chemical products which were exhibited by several firms there which required ethylic alcohol for their production. You have had better authorities than myself on those compounds; Mr. Green, I think, has given evidence, or will give evidence, and he is a very much better authority than myself. There was an exhibit, for instance, of technical preparations of the aromatic series in class A. In that class there were eleven derivatives of ethylic alcohol; they were not all finished products, but some of them were intermediate products which were used for producing others. They were practically secondary materials. There was mono-ethylaniline, for instance, and there was ethyl-benz-aniline and diethyl aniline.

2930. All more or less connected with the colour industry ?—Those were.

2931. (*Dr. Thorpe.*) Which were made from denatured spirit ?—They were made from spirit that was denatured in the way in which it was done in Germany, but not from methylated spirit.

Alcohol for refining sugar. (*See also* Qs. 2994–6.)

2932. (*Chairman.*) Still not absolutely pure spirit ?—That is so, I think. Then I may mention other industries into which the use of alcohol is said to enter very largely, for instance, the sugar industry. They said that a very large quantity of alcohol was used in that.

2933. Do you know in what way ?—Yes, I was told the way in which it was used. A sucrate of lime was formed and that was treated with alcohol, being practically washed in it.

2934. For refining purposes ?—Yes.

2935. Is that process in use anywhere at this time ?—I believe it is used considerably in Germany.

2936. (*Dr. Thorpe.*) Does that mean that the sucrate was washed free from any adherent molasses ?—Yes by means of the alcohol. Being soluble in water they could not use water. They used previously to use strontium salts which were scarcely soluble in water and then they could use water; but they found it was cheaper to make a sucrate of lime and to wash that with alcohol in which it was practically insoluble.

2937. That alcohol being, of course, recovered ?—Yes; it could not, of course, be remunerative without.

Mr. W. F. Reid.

14 Dec. 1904.

2938. (*Chairman.*) Then the actual consumption of alcohol would not be so very large ?—It would only be the waste.

2939. (*Dr. Thorpe,*) That alcohol presumably was denatured ?—I could not say that; I do not know in what way they would denature it without affecting the taste of the sugar. Of course that information is easily obtainable.

Spirit varnish and lacquer.

2940. (*Chairman.*) Then you conclude with a reference to varnishes. All the varnishes in this country, with a very small exception, are made with ordinary methylated spirit, are they not ?—Yes, I believe so.

Superiority of foreign lacquers.

2941. Is there any serious objection taken to methylated spirit by the varnish makers ?—It is useless for them to make any objection, because it is the only material they have to use; but they know that other varnishes are being made on the Continent with pure spirit which are superior to their own.

2942. It is not absolutely pure—they have to add something on the Continent ?—Yes, there is some material put in which denatures it, but it is not of the same nature as our denaturing agent and gives better results.

2943. (*Dr. Thorpe.*) It is only a question of degree; do you mean to say they do not use wood naphtha on the Continent for denaturing ?—Certainly they do.

2944. They do not use quite 10 per cent.; is that what you mean ?—I mean that in a case like that they would allow them to use some other denaturing agent. Supposing, for instance, they make a solution of shellac, they might allow them to use shellac dissolved in spirit.

2945. (*Chairman.*) I think they allow turpentine ?—Turpentine would be more suitable, in my opinion, than methylated spirit or methylic alcohol.

2946. (*Dr. Thorpe.*) We know exactly what they use in the varnish trade in Germany; it is all set out in published returns ?—Yes, no doubt you have that information.

2947. (*Chairman.*) Under varnish do you include lacquer ?—Yes, especially lacquer in this case, because we should call spirit varnishes lacquer practically. What we call a varnish is usually an oil varnish.

2948. Therefore really the statement that it is impossible to make a high-class varnish with an impure spirit refers to what is called lacquer ?—Yes, to a lacquer made of spirit varnish.

2949. That is not what is commonly called varnish ?—No. We call a spirit varnish, that is a varnish in which the solvent is spirit, a lacquer. Generally, where such a spirit-varnish, which usually contains shellac, is applied to a metal and then warmed that is what we call lacquer.

2950. Are you consulted at all by varnish makers?—Yes, I have several clients who make varnish on a very large scale—some of the largest in the country.

(*See* Mr. T. Gardiner's evidence.)

2951. We have had some evidence from two witnesses on this point, and one of them, who represented a very old and large firm in Birmingham, gave evidence in a contrary sense to this, and assured the Committee that the methylated spirit was really quite satisfactory, except in just a very few cases which are so insignificant as not to matter, in which they did use pure spirit ?—There are many of our manufacturers who really do not know all that is being done on the Continent. They lose their trade, and they do not often know how. They are not technically trained men, and they have not the technical knowledge to follow up a thing sometimes. They go by rule of thumb more than anything else.

Import duty on lacquer, etc. Effect of abolition.

2952. As regards this particular trade, assuming that they were allowed to use spirit duty-free under conditions that were easier than the present ones with methylated spirit—in fact, in such way as to put them in all respects exactly on a par with their German competitors, then immediately all ground for any import duty whatever on varnish or lacquer disappears ?—Yes.

Foreign competition in lacquer less severe than in lacquered goods.

2953. The present import duty is such that it is practically prohibitive; and if that disappeared, they would then open the whole of their English market to their German competitors, who are at present excluded. Do you think that the disadvantages under which they suffer from methylated spirit are such as to induce them to accept that condition with satisfaction ?—I look at it more from the national point of view. I think it is not so much the varnish alone that is imported into this country from other countries that we have to consider; there are also the goods which are varnished by these varnishes. Cheap German metal goods, for instance, all sorts of fittings and brass work of all kinds, are lacquered with these superior lacquers or cheaper lacquers, and these compete with our manufacturers here, not only as regards the lacquer, which is a small portion of the cost, but as regards the whole cost of producing those goods.

2954. Evidence that the Committee has had has been exactly in the contrary direction. We had a large user of lacquer who told us that notwithstanding any disadvantages that our lacquer suffers under, notwithstanding the high import duties on their goods when they get to Germany, France, and even America, they were able to do a very large and flourishing export trade with the Continent and even with the United States of America ?—In spirit lacquers ? (*See* Qs. 1878-81.)

2955. In the goods that were lacquered with spirit lacquers, and also in the lacquer. But, as you said, it is not so much perhaps the lacquer as the goods to which the lacquer was applied. The evidence of that firm, however, was rather in the opposite direction—that is to say, that they were able to invade the foreign market rather than that the foreigner was able to invade this market ?—I think it depends a good deal on the class of the goods. I am speaking chiefly of some of the cheap German goods that come over here—toys and all that sort of thing. For the higher class goods our people would probably command the market, because of the quality of the metal, but not so much because of the finish. In some kinds of goods, especially cheap goods where there is a good deal of labour in the making of them—there, I think, the foreigner would have an advantage—through the finish of the article only. I do not think it is a very important matter, but I think it is one in which it would be an advantage if our manufacturers could have better facilities. But I think I ought to say that there is one point that might be overlooked in the case of the ordinary manufacturer—that is, that when he uses a pure spirit he has got a more concentrated spirit than he would have if he were to buy methylated spirit, and a more concentrated spirit will certainly produce a brighter lacquer. So I think comparative experiments, unless they are made by an expert, are apt to be fallacious. If he takes a pint of pure alcohol which he has bought as a pint of pure alcohol, and then a pint of methylated spirit which he has bought just simply as a pint of methylated spirit, and he uses those two and makes experiments comparatively with those two liquids, then of course he is introducing an element of uncertainty, because of the greater concentration of the pure spirit.

Superiority of pure spirit lacquer.

2956. (*Dr. Thorpe,*) But supposing he uses a spirit of exactly the same percentage of strength ?—In that case I think the pure spirit would be decidedly better than the methylated spirit.

2957. But why ?—Because if you have two solvents for a substance, the two solvents will never, when they evaporate, leave that substance in exactly the same way. In a methylated spirit you have got the methyl alcohol and the ethyl alcohol; both of them dissolve (say) shellac, and when the lacquer is applied the evaporation of the two liquids will be at different rates, so there you must get a different result from that cause alone.

2958. The methyl alcohol is the more volatile of the two; it goes first. So if there is anything in your point, what is left is a gradually increasing ethyl alcoholic solution of the lacquer ?—Yes.

2959. Therefore you get eventually to what you desire ?—No, because another element comes in which will altogether change the thing—that is, the moisture. You do get a certain amount of moisture attracted from the air in all cases. Then of course you get three different liquids together.

2960. You have just as much in the one as in the other—the moisture is an addition which is common to the two cases ?—At the time that the methyl alcohol has evaporated, then, of course, the solution is too concentrated for it to flow any longer; and you would get a dull appearance and a sort of milkiness on the film, if you have one of the solvents evaporating more rapidly than the other.

Specimens of lacquer work. (*See* Qs. 1842 and 2998-93.)

2961. (*Chairman.*) We had some specimens of lacquer work put before us, one done with pure spirit, another done

with methylated spirit, and another done with wood naphtha only, and I do not think that any of our inexperienced eyes could detect any difference between the appearance of the methylated spirit lacquer and the appearances of the others. That was more or less admitted by the witness, who, however, said that the real mischief did not show itself until after a certain time, but that after a certain period of exposure the methylated spirit lacquer dulled and the pure spirit lacquer did not. We will have those specimens brought in, and then we shall perhaps be able to see whether there is any effect shown. It is about a fortnight or three weeks since we last saw them ?—I could not say anything with regard to the cause of the subsequent deterioration of a film that might be bright at the beginning; but that agrees with what we find with regard to nitro-cellulose—that there is a subsequent decomposition. There are some impurities in the wood spirit—I will not say in the methyl alcohol, because if the methyl alcohol were pure, it probably would not act in that way—but in the wood spirit there are undoubtedly substances that become acid after a time.

Artificialsilk. High price of spirit has been a barrier to the industry in this country.

2962. (*Sir W. H. Holland.*) May we take it that in your opinion the cost of the alcohol has been a fatal barrier, either to the establishment or to the development of the artfiicial silk industry in this country ?—I say so decidedly.

2963. That being so, do you think that much labour that might have been employed in that industry has gone unemployed because of the impossibility of carrying on the industry ?—I think so. We have the talent here, and we have all the necessary labour and capital; it was tried and it failed.

2964. I think you say you have no direct knowledge of the Coventry experiment ?—Personally I have not been into the works, but I have heard a very great deal about it, and I have seen the managing director and others and have obtained information upon it. But probably you will find gentlemen who were actually engaged in the works, who can give it to you at first hand.

2965. Personally I am very anxious to get to the bottom of the Coventry case ?—I am sorry that I cannot help you further. I can tell you the increase in the consumption of alcohol in one factory. It rises from 66,000 gallons in 1895 to 550,000 gallons in 1903, and I believe they have got about 1,500 hands.

2966. (*Dr. Thorpe.*) Are you talking now of the artificial silk factory at Besançon ?—Yes.

Success of the industry on the Continent.

2967. (*Sir W. H. Holland.*) I understand there are other processes in connection with the artificial silk industry which do not use alcohol, so that that particular industry has obtained enormous success on the Continent ?—Yes. That shows that it meets a great want in textile factories. It is a thing that is almost bound to go on, if facilities are given.

2968. You mentioned that you had heard Mr. Cash's paper on this question ?—Yes; I think I have a copy with me. (*Handing in prints of the Journal of the Society of Arts.*)

The Coventry enterprise. Reasons assigned for its failure.

(For Mr. Cash's evidence *see* Qs. 5462–5655.)

2969. Can you say that the cost of their raw material, which was alcohol, was the chief cause of the failure of the Coventry experiment ?—That was the conclusion that I arrived at, after going into it.

2970. Is that the conclusion Mr. Cash had arrived at, as expressed in his paper ?—His paper was read before the result of the experiment was known. He does not express any such fear in his paper.

2971. Was not one cause of their failure that they had not free access to pure alcohol ?—The impression which I wish to convey is this, that they could get any quantity of cheap methylated spirit, but that methylated spirit was not suitable for their purposes, as I know from my own personal work, so that they could not use it, however cheap it may have been.

2972. (*Dr. Thorpe.*) Do you wish to say that that was the cause why they were unable to go on ?—I believe that was the cause.

2973. Do you know ?—I know of my own personal knowledge that it would be a cause which would prevent an industry taking root in this country, as compared with another country where they could get a purer material.

2974. (*Sir W. H. Holland.*) Is Mr. Cash still living ?—I should think he would be living, but I do not know where he is at the moment; perhaps the Secretary of the Society of Arts could find him.

Conditions of manufacture in France.

2975. (*Dr. Thorpe.*) Do you think that they use pure alcohol at Besançon ?—No, I do not say that they use pure alcohol there, but I say that they do not use our denatured spirit.

2976. But they do use a denatured alcohol ?—They do use a denatured alcohol probably, but I will not be certain. I have not been in that factory, so I would rather not say.

2977. They would use the French denatured alcohol ?—Yes

2978. But the French denatured alcohol contains more wood spirit than ours ?—I would like to say that they have a great number of denatured alcohols in France.

2979. I am talking of the denatured alcohol which is used at Besançon ?—I would say this—that in 1902 they used for chemical and pharmaceutical products 6,000 hectolitres, whereas in 1903 they used 27,000 hectolitres. The difference, which is 450 per cent., would probably be made up by the increase in the use of artificial silk, because there is no other item in which there is such a large increase. Consequently, I think that they have got this item of artificial silk under chemical and pharmaceutical products; and for those they have a number of means of denaturing. They would not use the general means.

2980. Judging from the statistics of the duty on spirit used in France, the spirit used for artificial silk would appear to be an ordinary manufacturing spirit containing 10 per cent. of wood naphtha ?—I have not been able to trace it myself.

Loss to British labour by failure of the industry in this country.

2981. (*Sir W. H. Holland.*) With respect to the loss of this industry for the manufacture of artificial silk in this country, would you be disposed to agree that that loss has been a colossal injury to the employment of British labour ?—I think it has been a very great loss indeed. I may say that it is not only because of the amount of artificial silk that is used, but that silk is used sometimes in a small proportion mixed up with other textiles, and therefore the whole of that business would go too. The silk may only be one-tenth of the material, but the whole business would go to the country where the artificial silk is produced.

2982. So it is easy to suppose that many of the unemployed to-day would be employed if this industry had been established; do you not consider that a reasonable assumption ?—I gave my opinion, I think, pretty fully in half-a-dozen lines in a paper I read before the Society of Arts last week, and, perhaps I might just read those few lines. I think the industry is lost to Great Britain; that is my own private impression. What I said was this: "It is, doubtless, true that other nations surpass us in certain articles such as aniline dyes or synthetic drugs; but the tendency of modern industry is for nations as well as individuals to specialise, and it by no means follows that, because other countries may be doing a remunerative business in articles that we once produced, we have lost the business." That is my general impression on such matters; but I think in this particular case we have lost the industry. It was attempted to be started here, and for one reason or another it has failed. There may be other causes for that failure, but my own impression is that the difficulties that were in the way of this industry with regard to the use of duty-free alcohol were the cause of the failure.

2983. My question did not relate at the moment to the precise difficulties that were in the way. It was merely a broad question as to whether you thought that the loss of this industry had crippled or diminished employment ?—That is my opinion in this particular case. May I refer to another point with regard to something that I happened to notice at St. Louis ? That is, with regard to dyeing. I saw some beautiful dyed goods in the French section, and I was told that the whole of those goods were dyed by the use of spirit.

French dyed goods at St. Louis Exhibition. (*See also* Qs. 2997-9.)

2984. (*Chairman.*) The application of the dye was by means of spirit ?—Yes; the dye was dissolved in spirit. I made inquiries there about the spirit that was used, and they said that they got it as pure as possible.

Mr. W. F. Reid.
14 Dec. 1904.

The men in charge would not give me—or, perhaps could not give me—the absolute way in which the spirit was denatured, but they said they got it as pure as possible, or else it would not give those bright tints. They said it was impossible to get those tints in any other way. I believe that in the statistics they say that some of the spirit is used in dyeing in France, and that its consumption for this purpose has risen from 41 hectolitres in 1902, to 532 hectolitres in 1903; so there is an industry which is growing like the silk. It is one that may come before you, and perhaps you will be able to help it if it should be introduced into this country. I do not think myself that methylated spirit could be used there, because it is the delicacy of the tints which they obtain which sells the goods.

2985. (*Dr. Thorpe.*) Still, methylated spirit was used in precisely similar circumstances when these coal tar dyes were first introduced?—Yes, but we have got a great distance away from that now.

2986. Mauve, which is one of the most delicate colours that you could have in the whole range of them, was a spirit dye that was made with methylated spirit?—But that is a colour where a slight tinge in the solvent would not matter at all, whereas if you get a very light pink or blue, the slightest trace would affect it. You have already got some traces of colour in the textile fabric, and you cannot get it absolutely white sometimes; if you have added to that a slight tint from the solvent, that would spoil the dye. I was shown a new process of tanning in the German department, where they use alcohol. I believe they use the spirit for dissolving the tanning out of the tanning material and use it on the skin direct. They say they can in that way do it in a very few days instead of taking several weeks.

Alcohol process for tanning.

2987. Are all these French things?—The tanning was German, and the dyeing was French. They had some beautiful dyed materials.

Lacquer specimens. (*See ante* Q. 2961.)

2988. (*Chairman.*) We have now got the three specimens of lacquer that I mentioned to you?—*That* is certainly the best.

2989. That is the one that is lacquered with a wood naphtha lacquer?—I think it is quite possible to make a good spirit varnish with pure wood naphtha or pure methyl alcohol.

2990. That is not a pure methyl alcohol varnish?—No; I understand that is lacquer made with the wood naphtha of which we put 10 per cent, into the methylated spirit. In all lacquer it depends upon the way the thing is handled as well.

2991. There is no question that to-day, after the two or three weeks we have had these specimens here, the one made with the wood naphtha lacquer is the brightest; that is obvious, I think, to the eye?—I think I could take one of the others and make it look as bright as that, without doing anything to it except putting it on a vessel, saturating it with vapour of alcohol, and then heating it quickly. I could then get the lacquer to flow, and it would be bright.

2992. (*Dr. Thorpe.*) Still, you must admit that in the wood naphtha lacquer which you say, judging from the specimens the Chairman has shown you, gives the best results, you have in the most concentrated form those so-called impurities which you allege affect the character of the lacquer?—My point with regard to the double solvent comes out very strongly there, because you can do better with a single solvent than you can with that same solvent when it is mixed in the proportion of 10 per cent. with some other solvent.

2993. Wood naphtha is about the most complex solvent that you could have, as it contains a number of substances, such as methyl alcohol, acetones, acetal, methyl acetate, and possibly other things which are inequally volatile?—I quite agree with you that there is a very large number.

Alcohol for refining sugar. (*See* Qs. 2932-9.)

2994. (*Sir W. H. Holland.*) You mentioned something about the use of alcohol in connection with the sugar industry: does that not suggest that there are very many industries whose operations would be facilitated by cheap alcohol; because what you said about the sugar industry, I daresay, surprised some who are not behind the scenes?—The sugar industry would, of course, employ a very great number of people on the land for the growth of the material that the sugar was made from, quite apart from the amount of sugar produced. But I do not know whether the mere facilities for the use of alcohol alone in that industry would make it possible to produce sugar in Great Britain at a remunerative price. There are other reasons, I think, why it could not; but all other things being equal it would of course be an advantage.

2995. And probably there may be other industries also in which a cheap alcohol might facilitate the operations?—There may be a great number, and there are a great number undoubtedly. The difficulty is something like the difficulty of saying whether a child in the cradle that is strangled there would have grown up to be a six-foot man or a five-foot eight man; you cannot tell what the baby would have done, if it had not been strangled. That is the position really that one is in.

2996. (*Sir William Crookes.*) Was it beet sugar or cane sugar that was being treated?—Beet sugar. I believe it is used chiefly in purifying the impure residues, where there is only a certain percentage of sugar in the molasses from the beetroot. They get the sucrate of lime, and they displace first with a small quantity of water and then they wash with spirit. I think that is the process, but I am not an expert in sugar.

2997. (*Mr. Nicholson.*) I understood you to say that the French dyes that you examined at St. Louis required the very purest spirit?—I was informed that they required it very pure. *See ante* Qs. 2983-6.

2998. If the manufacturers were allowed to use duty-free alcohol they in the same way, I imagine, would try to obtain the very purest and most neutral spirit?—Yes, they would.

2999. In fact, a highly rectified spirit?—Yes.

Nitro-cellulose powders made with methylated spirit. (*See ante* Qs. 2896-900.) Unsatisfactory results attributed to uncertain nature of wood naphtha.

3000. (*Mr. Tyrer.*) Dr. Thorpe referred just now to the complicated character of the composition of wood naphtha. While the argument may perhaps fall to the ground with regard to lacquer, is it not because of the almost indescribable number or character of the contents of ordinary wood naphtha that the danger in the case of nitro-cellulose powder comes?—Yes, that is so. You are putting into your solvent a material that contains substances you have not any idea about and you do not know what they are. First of all, the wood naphtha is distilled from any kind of wood. You do not know what kind of wood, and the manufacturer himself does not know what kind of wood he is going to use from one week to another. It is very rarely that the wood naphtha is distilled from one particular kind of wood. Then there are alterations in the temperature of distillation and variations in the processes of separating the naphtha.

3001. Which accounts for the difference in character of these bodies?—Yes, I should not be at all surprised if somebody were to sum up a hundred different bodies in wood naphtha. There are a great number of bodies, some present in small quantities, some in large. The great point about it is this, that we do not know them all. If we knew them all, we could take precautions, but we do not know them all.

This theory discussed.

3002. (*Dr. Thorpe.*) You know I examine, say, a thousand samples of wood naphtha in the course of the year; and probably I obtain more actual knowledge of the composition of wood naphtha than anybody else because I get it from all parts and of all origins. I venture to say to you that the wood naphtha used is not of the extraordinarily dissimilar character that you say, and that it is really fairly uniform in character. But you do not agree with that?—I do not agree at all.

3003. On what ground can you disagree?—I disagree on this ground, that we actually get reactions from wood naphtha which we cannot trace to any particular body that is in the wood naphtha. We find, that the heat test of nitro-cellulose which has been dissolved in the presence of wood naphtha gives us worse results—it gives out a lower heat test—than without the wood naphtha. That I proved to my own satisfaction very many years ago. If you cannot trace the particular substance that does that, then there is something in the wood naphtha that we have not traced. But quite apart from that I do not think that the testing on certain lines of any number of samples of a given product will tell us what the things are really in that product. We have analysed the atmosphere for half a century and

we have missed four or five gases in it. There may be numbers of things that are in the spirit that have happened to elude even Dr. Thorpe's careful investigation.

3004. That kind of argument does not go very far of course?—Here we have to deal with small quantities of things that exercise considerable influence on the particular substances that they are brought into contact with; and those things have not, to my knowledge, been isolated.

3005. Can you tell the Committee that you have found from time to time in your heat test on powders, when made from methylated spirit, great variations in the results which you can attribute to the varying character of the wood naphtha which may have been incidentally employed?—I have found that I have no other reason to attribute it to anything excepting the impurities in the methylated spirit, because the ethyl alcohol itself did not deteriorate.

3006. That is not an answer to my question. I asked you if you had found variations in the results of your heat tests applied to nitro-cellulose powders made with methylated spirits of different characters?—Yes, I have found variations continually. I understood that I was replying to that.

3007. You did not say so?—I certainly meant to convey the idea that the material that one was using—methylated spirit—varied so continually that I did get differing results.

3008. You put the cart before the horse—you got different results?—From the same batch of material otherwise, simply by using a different solvent and a different methylated spirit.

3009. Pardon me, you apply certain heat tests to the powder you tell me?—Yes.

3010. Powder which has been derived incidentally by the use of methylated spirit, is it not so?—I do not quite follow the word "incidentally."

3011. Have you ever used methylated spirit in connection with the preparation of those powders?—Yes, very frequently.

3012. You have found that when you made the heat test with those powders the heat tests themselves varied?—Yes, that is so.

3013. And you attribute that variation to the varying character of the wood naphtha which has been used in methylating?—Yes.

3014. Why do you do that?—Because of the observation that the heat test varies when I use different samples of the substance.

3015. There you are confusing cause and effect. You have got a variable, namely, your heat test. I asked you how you account for that variable, and you say it is because of the variable character of the wood naphtha?—I think it is a logical conclusion that if you alter nothing except one of the reagents or of the materials that you use, and you find varying results with different qualities of that re-agent then you must attribute it to that re-agent. That is what I did, anyhow, whether it is logical or not.

3016. Of course, I require to know the conditions under which each test was applied, and what is the difference of error of the experiment determining the heat test, before I can say to what you must attribute the variation. But you beg the question when you put it down to the varying character of the wood naphtha. May I point out, because you have not proved that it is so, that that is what you ascribe in your own mind as the cause, without any proof of it; it is a surmise of your own?—I think it was the result of very careful experimental work that could be repeated, and I think if it were repeated the same result would be obtained by other experimenters. I think I can say no more from a scientific point of view.

Mr. W. F. Reid.
14 Dec. 1904.

3017. We have had this over with Dr. Silberrad. Could you throw any further light than he could as to what it is in wood naphtha which has this effect upon the powder?—I have ideas upon the subject certainly.

Not impossible to make nitro-cellulose powders from methylated spirit, but dangerous.

3018. Can you tell the Committee that it is impossible to make nitro-cellulose powders with the use of methylated spirit? Are not nitro-cellulose powders made to-day with the use of methylated spirit?—I would not like to say that it is impossible to do so, the more so as I have myself made powders in that way. But it is dangerous and a manufacturer does not like to risk the lives of his workmen for the sake of a thing that he can avoid. We now use a lot of acetone made from substances that we buy abroad, and our nation is dependent upon the supply from abroad, because we have not been able to get the pure spirit which might be substituted for acetone in this country. It is a humiliating position for an English manufacturer to be in that he has to do it; he must get a living somehow; he must produce the article.

3019. (*Mr. Tyrer.*) The fact remains that if to-day under these recent conditions the manufacturers of powder asked for concessions they would have them, which is a clear advantage of the 1902 Act?—Yes, I understand so.

Suitability of pure methyl alcohol questioned, either as a denaturant.

3020. (*Sir William Crookes.*) I should like to ask you one further question connected with powder. Supposing you have perfectly pure alcohol, absolute alcohol, and equally pure methyl alcohol, and mix those in the proportion in which they are used in methylated spirit, could you make a good nitro-cellulose powder from that mixture?—I think you could. But my experience generally is that methyl alcohol is rather dangerous, because there is a tendency, so far as I can trace it—I hope Dr. Thorpe will not take it as a definite scientific statement on my part, which it is not; but I have found traces of formic acid in nitro-products that have been in contact with methyl alcohol. I have found that, and that undoubtedly lowers the heat test very considerably.

3021. The formic acid is produced during the operation of dissolving and evaporating, is it not?—Yes.

3022. I am assuming that there is no formic acid present to begin with?—That is quite true to begin with, but I am afraid it might be produced afterwards in contact with the nitro-cellulose.

or as a solvent with ether.

3023. Have you ever tried to use methyl alcohol with ether as a solvent?—Yes.

3024. How does the powder do then?—As regards the heat test, it was not satisfactory. I did not go on with the thing on a large scale like I have with these other solvents, which I have used on a very much larger scale; but I do not think the heat test would be so good. That is the general impression which I have.

Mr. JOHN WALKER LEITCH, called; and Examined.

3025-6. You come from Huddersfield, I understand?—Yes.

3027. What is the name of your firm?—John W. Leitch & Co.

3028. Their business is what?—Aniline dye manufacturers.

3029. Have you been long established?—Since 1891.

Finance Act, 1902, S. 8. Production of tolidine with specially denatured spirit.

3030. I suppose you manufacture a number of dyes, in which you do not use alcohol?—Yes, one or two.

3031. You made an application, I think, to the Board of Inland Revenue this year in connection with the use of alcohol for rather a special purpose—namely, the manufacture of tolidine and benzidine?—Yes.

Mr. J. W. Leitch.
14 Dec. 1904.

3032. Are the arrangements that have been made under the power that was then granted to you satisfactory?—Yes.

3033. Tolidine and benzidine are intermediate products in the manufacture of dye stuffs, I believe?—Yes, that is so.

3034. Do you yourselves work them up into dyes?—No, we make these intermediate products for sale in Germany and Switzerland.

3035. Not in this country?—There is very little of it used in this country I think; but there is a little.

3036. Of which do you mean?—Of tolidine.

Mr. J. W. Leitch.

14 Dec. 1904.

3037. What do you say with regard to benzidine?—We have not begun with benzidine yet. It is used the same as tolidine; only it makes different shades of colours.

3038. Is your interest in the use of alcohol confined to your manufacture of tolidine?—Yes, and of benzidine for the present.

3039. Then as regards any other branches of your manufacture, would you use alcohol if you could get it cheaper?—We have not any other use at the moment, but we might extend the other uses.

3040. Up to the present you have not any other uses?—No; tolidine and benzidine are the only things we make with alcohol.

Regulations as to supply of spirit.

3041. What are the exact arrangements that we have sanctioned for you? You are allowed to bring the spirit in pure, I believe?—Yes.

3042. Perfectly pure?—Yes.

3043. And of a high strength?—Yes.

3044. What happens when it gets into the works?—We put it into a building prepared for the purpose; advise the supervisor at Huddersfield, giving him twenty-four hours' notice; he comes and denatures it with nitro-toluol, which we provide, and thereafter unlocks our mixing vats which are provided for the purpose. We can then use it by running it into our stills, and we recover it under lock. Then when we have a certain amount recovered, he comes and denatures it again.

Spirit denatured on the works with nitro-toluol.

3045. What is the percentage of nitro-toluol which you have to put in?—Two per cent.

3046. Does that very effectually denature it for the time being?—We understand so.

3047. Would it take away any desire to drink it?—I should think so. It is very bitter and poisonous.

3048. Is there any smell with it?—In the material itself, do you mean?

3049. I mean, does the denatured spirit smell?—No, I do not think you can discover the smell of the nitro-toluol in it. The smell of the spirit is so pungent itself that it overcomes the smell of the nitro-toluol. I understand that it is very bitter, but I have not tasted it.

Price of spirit not a bar to successful competition in Germany with German-made tolidine. (*See also* Qs. 3101-5.)

3050. As regards the price that you have to pay for the spirit, do you find that that is an obstacle to the profitable pursuit of your industry?—We believe that the Germans can buy it cheaper than we can, and the Germans are our only competitors. It is not made in England, or in any other country than Germany, and the chief consumers of tolidine are up to the present in Germany and Switzerland.

3051. You have to fix your price in the markets abroad relatively to the price that is charged by your German competitors?—Yes.

3052. Do you find that that leaves you a very small margin of profit?—Yes, we find on the whole manufacture now that the margin is very small.

3053. But still you do make a profit?—Yes, there is a margin.

3054. Would the margin be substantially increased if you could get your spirits cheaper by 6d. per gallon on the strong spirit?—It would be effective, but I have not calculated to what extent.

3055. Would it make a difference?—It would certainly help us to compete. The competition now has become very keen.

3056. But you have only just started this?—Yes.

3057. Do you consider your experience is sufficient to say whether you would be able to go on making it a profit—do you feel any doubt about it?—At the moment we shall be able to compete, but of course as we get more fully into the market the competition will become more keen. We have felt that with other products which we make which are chiefly used in the German market by the German colour manufacturers and which have hitherto been chiefly made in Germany.

3058. Where do you find your market principally?—In Germany and Switzerland.

3059. Is there any tax upon it—any import duty when it reaches Germany?—There is none on our goods. There is a small import tax in Switzerland, which is merely nominal—about a shilling per 100 kilos.

Still better prospects when a market is found for a by-product (zinc chloride).

3060. Have you effected any contracts for a considerable amount or for a considerable period?—No, we have not been able to do that, because we have not made the progress we expected. In the manufacture of this tolidine there is a by-product formed, and that is the chief difficulty which we have in making large quantities. The by-product is zinc chloride, and that must be disposed of, because it is made in a very large quantity. In the reduction of nitro-toluol to tolidine, it has to be reduced by zinc, which first forms zinc oxide and then forms zinc chloride, and is recovered in that way. As soon as we get a market for zinc chloride, we shall be able to go on in full swing, and make as much as the plant we have arranged for will enable us to make.

3061. Have you hopes of getting a market for your zinc chloride?—Yes. But at present there are large quantities of it, and we find a difficulty in striking into the market. Other people are supplying at the present time and they are fighting for the market to retain it. That is the chief difficulty we have found, namely, getting a market for the zinc chloride.

3062. Is the market you are aiming at invading in this country or abroad?—It is in Lancashire.

3063. (*Dr. Thorpe.*) In connection with the cotton industry?—Exactly. It is used in sizing, and perhaps it is used in weighting—I do not know.

3064. (*Sir W. H. Holland.*) Who are your competitors in Lancashire; are they foreign or British firm?—They are only English firms.

3065. (*Chairman.*) You cannot at present say that the high price of English spirit is preventing your carrying on this business?—No, I cannot say that. Only if there were no duty——

3066. Naturally you would be pleased to have your spirit cheaper?—Quite so; it would help us.

3067. What sort of quantity are you using at the present moment?—We have permission to use 10,000 gallons per annum.

Quantity of spirit used.

3068. How much are you using?—We will be using about that rate presently, but if we were in full swing with the plant we have laid down, we should use from two to two and a half times that quantity only for tolidine; and then if we went on to benzidine, we should use from five to seven and a half times that quantity.

3069. (*Mr. Tyrer.*) That would be about 60,000 gallons a year?—Yes.

Suggestion of a rebate on alcohol used for industrial purposes.

3070. (*Chairman.*) Then you make a suggestion for the consideration of the Committee that it would be desirable to grant a rebate to the distiller on all alcohol used for industrial purposes only?—Yes, I do.

3071. Take your own case. Supposing that instead of granting it to the distiller we granted it to you; that surely would be taking a certain amount out of the spirit revenue in order to cheapen your alcohol, would it not?—Yes.

3072. I can quite understand your wishing that, but in the face of what you have told us, do you think that that would be quite justifiable?—I understand that the spirit which the Germans can buy is just about that much cheaper than we can buy it at; it is with the object of getting exactly on a level with the German in the cost of the alcohol. There is a certain loss every time.

Loss of spirit in manufacture.

3073. (*Mr. Tyrer.*) What is that loss—about?—We have never been able to get a better return than a recovery of 75 per cent. That is a loss of 25 per cent., which is a very serious one.

3074. (*Chairman.*) A good deal of the 10,000 gallons that you are using then is used over and over again?—Yes, 75 per cent. of it; it goes round and round.

3075. So you really are using a considerable amount from day to day?—Yes. We should use much more if we could get in full swing; that is, if we could get rid of our zinc chloride, because we can sell the tolidine. Our connections run in that direction, and we can sell our tolidine at an equal price with the German maker—and they are only German makers who sell it.

No market yet for tolidine in United Kingdom

3076. Why cannot you find any market for the tolidine in this country?—The colours that are made from tolidine

owing to German colour patents.

are, some of them, made from patents which have only just expired, and others from patents which have not expired. They are every one of them German patents. In time, tolidine will be used in this country, as the English manufacturers of colours cut in. It appears, however, that now there is very little inducement, although there is always a little margin on these things, for them to come in against German competition. When the patents are expired, they may do so.

Cost of carriage to Germany.

3077. Then you may have a good market here ?—Yes, in England; but at present even under equal circumstances we would have the carriage against us to Germany.

3078. (*Dr. Thorpe.*) May I ask where you deliver it in Germany ?—At Elberfeld, and Frankfort-on-the-Main.

3079. Have you any idea what it costs to take it up there ?—It costs a farthing per lb. to Elberfeld, and only a halfpenny per lb. to Basle—the actual figures being ·3d and ·45d. respectively.

3080. (*Chairman.*) What is the selling price per lb. of this tolidine ?—1s. 3½d.

3081. Then that is a heavy percentage ?—Yes, but we have to pay that on a fivepenny article also.

3082. (*Mr. Tyrer.*) That is on the bulk, is it not—packages included ?—It is on the net weight.

3083. What do you say it is exactly to Frankfort-on-the-Main ?—·3d.

3084. Is it exactly the same to Elberfeld ?—Yes.

3085. (*Dr. Thorpe.*) A good deal of it is water-borne by Rotterdam, is it not ?—No. We have great difficulty in getting the barges to take it up the Rhine. The railway companies will take it, and the barges sometimes will take it, but sometimes they go on strike and say they will not. I do not know why that is. We have just got to do as they will do with us.

3086. (*Mr. Tyrer.*) It is not odoriferous, is it ?—No.

3087. Is there an element of danger in it ?—Not in the tolidine. But they do not understand it, and so sometimes they say they will not take it, but sometimes they can be coaxed into taking it.

3088. (*Sir W. H. Holland.*) They think it is dynamite perhaps ?—Possibly.

Cost of Excise supervision, direct and indirect (*See also* Qs. 3109–12).

3089. (*Chairman.*) I see that another suggestion you make in your *précis* is that you ought not to be charged with the cost of supervision; the amount that we have asked you to pay is a comparatively small sum—it is only 10s. a week ?—That is so.

3090. That only comes to £26 a year ?—Yes.

3091. Still, as you think that the supervision is exercised in our interest and not in yours, in your opinion we ought to pay for it ?—Yes. Then we have £10 to pay to the insurance company for the bond, and we have the interest on the capital that we have laid out in this building and on plant; all of which would have been unnecessary but for this supervision. The building and the plant have cost about £500. We want to be on equal terms with the Germans. We do not care if there is a tax of 20s. on the article if the Germans are paying the same tax. Three years ago even, no charge like that would have been of any interest to us, because the margin was large enough to allow for that; but now, within the last three years, it has been cut down very keenly.

3092. I thought you had only just begun the making of tolidine ?—I am speaking of other things as well.

Advantage over German manufacturers in having a denaturant ancillary to process of manufacture.

3093. (*Dr. Thorpe.*) May I point out that you are in this favourable position as regards your German competitors, that you use a denaturant which is, as I may say, ancillary to your process, which does you no harm, and which in fact is something that you have to use in any case in connection with it ?—Yes.

3094. Your German competitor is not in that happy condition ?—Is he not ?

3095. No, because he has got to use one of four things; he may take his choice of which, but none of them is required for what he wants to do ?—But perhaps the percentages are not serious.

3096. The percentage may or may not be serious, and would depend on which he cares to take; but whatever it may be it costs him something, whereas your denaturant does not cost you anything as a denaturant, because you have to use it in your process ?—Supposing the percentage was very little, then it would cost the Germans practically nothing.

3097. I do not say how much it is, but supposing it were ·025 per cent. of animal oil it would cost him something ?—Yes, it would, but that would be very trifling.

3098-3100. *Pro tanto*, so far as it goes, you are in a better position than he is in that respect ?—Yes, so far as it goes.

Export of tolidine.

3101. (*Mr. Tyrer.*) Your ability to export tolidine to Germany duty free arises because of its being in the nature of a raw material for their manufactures, does it not ?—Tolidine is a raw material for their manufactures.

3102. And therefore it goes in duty-free ?—Yes.

3103. But if it were a finished manufacture, such as a dye, I suppose a duty would be put upon it ?—No, there is no duty on dyes going into Germany.

3104. Is there no duty on dyes at all ?—No, not up to the present time, but there have been talks of a duty. We are sending dyes into Germany, but not much.

3105. (*Sir W. H. Holland.*) Is that because they think they are strong enough to defy the world's competition ?—Yes, and they are, really.

Cost of Excise supervision borne by manufacturers in France and Germany.

3106. (*Dr. Thorpe.*) Of course you are aware that the cost of supervision and any charges on the revenue are borne by the manufacturer both in Germany and in France ?—No, I am not aware of that.

3107. In fact the manufacturer in Germany and in France has equally to bear with the manufacturer here any charges which are required by the authorities to protect the Revenue ?—I did not know that. I have been in conversation with many of them, but I have learnt nothing, except that they had alcohol absolutely free.

3108. In your *précis* you say: "The Regulations of the Revenue Board with regard to the fitting up of the stills and the various connections are productive of much delay in getting the plant into work." You do not allege, do you, that anything we required you to do in any way interfered with your operations or stopped them ?—No; only it would have meant, we thought, a few weeks delay if everything had to be referred to Somerset House—even trifles which did not affect the principle of what had already been granted.

Cost of Excise supervision. *See* Q. 3089.

3109. The cost of supervision in your case has been stated; but have you calculated out what it means per gallon on your 10,000 gallons ?—No, I have not. I have only looked upon it as being another £26 per annum.

3110. It comes to a little over a half-penny per gallon if 10,000 gallons are used annually ?—I did not think it would be so much as that. That amounts to about 4 per cent. on the cost of the alcohol.

3111. (*Mr. Nicholson.*) What is the price that you pay for your alcohol ?—Ninepence three farthings for the proof gallon, which is about 1s. 4¼d. for 66 over proof. It would therefore be a 32nd, or 3 per cent. Then the other charges would run up to twice that amount. Indeed, I think with the bond interest and the plant it would come to nearly 10 per cent. on the cost of the alcohol.

Generally satisactory working of concession under Finance Act, 1902.

3112. Of course you admit the necessity for Excise supervision ?—Yes, certainly. Excise supervision has worked very well with us. We have to be very careful to give them ample notice, so that we do not stop our works. It can be done very well in the tolidine and benzidine manufacture. The arrangement can be worked very harmoniously.

3113. (*Mr. Tyrer.*) Are the Inland Revenue officers present when you are working ?—They make visits at other times than when we send for them.

3114. Without notice ?—Yes; but they are not necessarily present when we are working. We send to them when we want them to denature either fresh spirit or recovered spirit. We have just got your permission to make an alteration in the plant, which will greatly decrease the officers' attendances for denaturing the recovered spirit. By inserting a locked pump we are able to pump into a larger reserve than we have at present, which will hold over 2,000 gallons. That would reduce the attendances by one half. I do not know whether I ought to mention that we understand that this recovered spirit is itself non-

Mr. J. W. Leitch.
14 Dec. 1904.

potable, owing to the impurities which it contains. In the manufacture of tolidine, there is toluidine formed, and that comes over with the recovered spirit. We understand that the analysis of Somerset House shows that the recovered spirit contains toluidine and is quite unpotable.

3115. (*Dr. Thorpe.*) I do not remember; still, as a matter of fact, you raise no objection to adding the nitrotoluol ?—No.

3116. You would have to do it in any case in your manufacture ?—Yes, we should have to do it; it is what we use to make tolidine.

Dr. JAMES TERENCE CONROY, called; and Examined.

Dr. J. T. Conroy.
14 Dec. 1904.

3117. (*Chairman.*) You attend on behalf of the Liverpool Chamber of Commerce, I believe ?—That is so.

3118. Your own particular business is connected with the United Alkali Company, Limited ?—Yes.

3119. What is your position in the Company ?—I am one of the chemists in their chief laboratory.

3120. Dealing first with what you propose to say on the question of drugs and pharmaceutical preparations, we have had a great deal of evidence quite lately on that subject directly from people who are connected with their manufacture; I rather gather from your *précis* that you yourself are not personally connected with it ?—I am not personally connected with the drug industry, but at the meeting of the Chamber of Commerce, Mr. Herbert Evans, representing the Liverpool house of Evans, Sons, Lescher & Webb, was present, and mentioned certain points to me. That is why I brought the latter into my *précis*.

Pharmaceutical preparations.

3121. (*Dr. Thorpe.*) We have already had evidence on the subject of pharmaceutical preparations from Mr. Webb, as representing that firm ?—Yes, I believe that Mr. Webb appeared here yesterday.

3122. (*Chairman.*) There is one question in connection with the subject that I should like to ask you, however. You mention that you have been informed that statistics covering the total trade of the country in these pharmaceutical products are being compiled for presentation to the Committee; who is doing that work ?—Those statistics were given you by Mr. Webb. As a matter of fact, they do not represent the total trade of the country; they represent the trade of ten or twelve of the largest houses.

Chemicals.

Increasing imports into United Kingdom.

These include a large number of products in which alcohol has no part.

3123. Further down you say that our imports of chemicals from Germany have risen steadily from £2,380,000 in 1890 to £3,170,000 in 1903; where do you get those figures from ?—I take them from the German figures published in *Die Chemische Industrie*. That is not actually an official journal, but it gives all those statistics.

3124. What have you included in the term "Chemicals ?"—That practically includes everything in chemicals, both raw materials and finished articles.

The figures discussed.

3125. Glancing at our own annual statements of trade, I do not see any figures that would seem to make up £3,170,000 or anything like that amount, under the head of Chemicals ?—Possibly not. I have copies of these German journals with me.

3126. Could you give me some of the items, because then we could verify their figures against our own ?—I am afraid our own figures will not correspond with the German figures.

3127. (*Dr. Thorpe.*) Have you got an analysis of the products included in the term "Chemicals ?"—I believe I have.

3128. (*Chairman.*) One of our difficulties in verifying the figures is that these products may come through Belgium or Holland ?—Yes. I was going to say in connection with that, that I have taken from the Statistical Abstract for the United Kingdom the figures relating to the imports of aniline dyes and coal tar colours. From Belgium there is £40,000 worth; from Germany £85,000 worth, and from Holland £900,000 worth. Those colours which are given as coming from Holland actually come from Germany, out of a total of, say, a million.

3129. That is to say, they come down the Rhine ?—Yes. The figures I have given you are taken from the Annual Statement of Trade for the United Kingdom for 1903 (Part 2).

3130. Do I understand that under this head of "Chemicals" you would include the aniline dyes ?—Yes, certainly. That term "Chemicals" includes all heavy chemicals and all drugs, and it also includes a certain proportion of mineral waters and gelatines. I have a list here, and it comes to over £2,000,000. It includes the potassium compounds, for instance.

3131. (*Dr. Thorpe.*) Of course a great many of the mineral waters imported from Germany are natural mineral waters ?—Yes, certainly.

3132. Those we cannot help ?—No, we cannot help that. And then we cannot help the import of the potash compounds to a large extent, because they are natural to Germany.

3133. That is another matter When you include mineral waters, you are thinking of things like Apollinaris water, are you not ?—Yes. Taking the German statistics, as I find them, I have made out this abstract, which gives £300,000 for potassium compounds, £320,000 for white lead and zinc compounds, £150,000 for alkaloids and essences (that will include liquid perfumes containing alcohol and ether), alizarine and indigo £230,000; aniline and aniline dyes, £1,000,000; mineral waters, £50,000; gelatines, £45,000; explosives, £35,000. Those, I think, come to £2,130,000.

3134. Are there any fine chemicals, as we call them, in that list ?—In the alkaloids and essences there most certainly are.

3135. Are there any inorganic fine chemicals sent to us from Germany ?—That I cannot say.

3136. I cannot find any place for them in the list you have just read out; where would they drop in ?—A great number of compounds come in simply under the heading of acids and simple substances; tannic acid is one of those.

3137. What is the aggregate value of these acids and simple substances which come from Germany ?—I cannot give you the values of the exports to this country from Germany of those substances. All the figures that I have just given you are the values of the exports from Germany to England as given in the German statistics. From Germany generally, that is to England and the rest of the world, general chemicals come to £5,500,000, of which £1,800,000 is for potassium salts. Dyes come to £8,500,000.

3138. The quantity of potassium salts coming to England you have already given us, I think ?—Yes, £300,000 worth comes to England out of the £1,800,000 worth sent to England and the rest of the world.

3139. Is there any considerable quantity of inorganic fine chemicals ? Can there be any of the inorganic substances coming to England from Germany in considerable quantity ?—Not of the inorganic.*

3140. Not into England ?—No, I think not, speaking quite apart from the potassium compounds. There may certainly be a fair percentage of potassium bromide and potassium iodide compounds, which I have not included under these general potash compounds, which come in for photographic purposes and for medicinal purposes.

3141. Are there any other fine inorganic chemicals of that type that we get from Germany included in your figures ?—No, I think not. Tannic acid is included in

*The Witness subsequently wrote:—In replying to this question, one manufactured article escaped my memory at the moment; this article being sodium hydrosulphite. The hydrosulphites are very largely used in indigo dyeing and a great deal of work has recently been done in improving the method of their manufacture. The Badische Anilin and Soda Fabrik has perhaps been the most active in this, and they have recently succeeded in producing a solid, stable, hydrosulphite; and according to their patent it would appear that in the obtainment of the solid hyposulphite the compound is washed with a liquid, such as alcohol or acetone, and finally with ether. Of course, I am unable to say whether this process is the one actually worked, but it is at least interesting in so far as it indicates the possibility of using alcohol and ether in the preparation of finer inorganic chemicals.

the list, but that is organic, of course. It is included along with simple acids and bases.

3142. (*Chairman.*) In your *précis*, after giving a great many figures about the export trade of Germany in those drugs and pharmaceutical preparations in which spirit is largely used, you ask "How can England compete against this"—— ?—Yes; there, as you see, I am dealing with the drug business—the manufacture of alkaloids, the manufacture of essences, the manufacture of artificial perfumes, and the manufacture of coal tar colours more especially.

3143. But the figures do not seem to me quite a fair illustration of what you want to contend. You say: "The conditions imposed by the State in the matter of alcohol have effectually checked manufacture, and we have had to buy abroad"; and then in order to illustrate that, you give us figures of which by far the greater mass relate to preparations which have nothing whatever to do with alcohol ?—Aniline and the aniline dyes count for £1,000,000 worth.

3144. You must rule out the whole of the alizarine, for instance ?—Yes. But I take it that alizarine and substances like indigo, are more or less an outcome of the spirit which has been created in Germany through their liberty to use alcohol.

3145. That is rather a remote inference. Really, what one would like to see would be, if you could do it, a comparison between the year 1890, say, and the year 1903, or any other two years that you like to take, showing the figures of imports of certain typical things, the manufacture or the preparation of which depends upon alcohol. I feel that it is rather vague to take these figures simply as they stand, is it not ?—It is very difficult to isolate these figures. We have not got sufficient figures in England to enable us to compare the German figures with them.* There is one thing I might mention, which is not in my *précis* of evidence. Under the importation of Raw Materials for Manufacture in Germany we have certain substances not specified—Raw Materials, otherwise unnamed, which are for general and medicinal purposes.

Raw materials for medicinal purposes. Re-exportation from United Kingdom in certain cases (*See* also Qs. 3156-60).

3146. Are you taking that from a German journal ?—Yes. I have abstracted the figures. In 1890 I find that the net import—that is, the import less the export—of these particular things was £22,000; and at the present time it is £200,000. That is a great rise; it has increased ten times in the course of the last thirteen or fourteen years The rise has been steady. Now under that heading will be included such things as Jaborandi and Calabar beans. Jaborandi comes into Liverpool from West Africa and 90 to 95 per cent. of it is re-shipped straight away to Germany.

3147. What is Jaborandi used for ?—It is for the extraction of the alkaloid, Pilocarpine, chiefly. The Calabar beans are used for the manufacture of eserine.

3148. There is a risk of drawing too great an inference from figures of that kind. If you take our Annual Statement of Trade and look at the imports and exports of medicinal preparation, I think you will see that we export a good deal more than we import ?—I do not think we are at all badly off in regard to our medicinal preparations.

Tinctures. Increased export since grant of drawback.

3149. Might we not fairly argue from that that we are doing rather well ?—We have been doing fairly well, I think, in that way. In that direction we have several facilities. There is, for one thing, this drawback in spirits, which has been a very marked advantage. Mr. Tyrer has shown over and over again that we had no export business practically before that drawback was granted, and that since then it has increased by leaps and bounds. The difficulty in connection with that—drawing upon the German figures again, for I am sorry to say I have not got the English figures here—is, that I find that roughly two-thirds of the value of our exports in tinctures, etc., comes from German made spirit. The spirit comes to this country, is bought by our own manufacturers, and after working up is re-shipped abroad.

Use of German spirit for tinctures in United Kingdom.

3150. (*Mr. Nicholson.*) That is purely a question of the price, is it not ?—It is purely a question of price. I found in *Die Chemische Industrie* in Dietzmann's articles on English trade for particular years that in recent years we have been using foreign spirit corresponding to £70,000 to £80,000 of alcoholic tinctures exported.

3151. It is no question of quality, is it; it is merely a question of price ?—It is merely a question of the price There is this differential duty, as I believe they call it—the special tax of 4d. or 5d. on the proof goollon.

3152. (*Chairman.*) In spite of that, they have used the German spirit ?—Yes, in spite of that.

3153. (*Dr. Thorpe.*) Up to quite recently, but not now ?—Up to quite recently. I have been told that English spirit is cheaper than German now, when that 5d. has been added.

3154. (*Mr. Tyrer.*) To-day ?—Yes, to-day.

3155. (*Chairman.*) They have always had the 4d. to contend against on the German spirit ?—Yes; but even then I believe the German spirit has been bought by most of our drug houses.

Treatment of re-exported substances with alcohol. (*See ante* Q. 3146.)

3156. That also may have something to do with the quality, may it not; the German spirit that is imported is a very highly recitified spirit ?—I might point out in connection with this Jaborandi, which is re-exported from Liverpool to the tune of 100 tons per annum, and also in connection with Calabar beans, which are re-exported from Liverpool to the tune of twenty-five tons per annum, that altogether there are between four and five treatments with alcohol or ether or with both, before the alkaloid is finally recovered from the bean or from the leaf. That must represent many thousands on the value of the alkaloid. I do not know what are the prices of thse particular alkaloids or what is the price of the leaves; still I say it must represent several thousands of pounds.

Recovery of spirit so used.

3157. (*Dr. Thorpe.*) The spirit, of course, is recovered ?—It is not all recovered.

3158. The greater part of that which is used for crystallising will be recovered ?—It is used for crystallising and for extracting, and it is simply evaporated away.

3159. No ?—When I say it is simply evaporated away, I mean evaporated off and of course recovered, as far as ordinary means will allow.

3160. But the greater part of it is recovered ?—Yes; still there is always a very appreciable loss.

3161. (*Mr. Tyrer.*) Are you aware that from experiments that have been made in England, it has been stated that the loss is close upon 25 per cent ?—Is it so

*The Witness subsequently wrote:—In further reply, I may perhaps be allowed to say that I have been able to collect the following figures bearing on the subject. The years compared are 1902 and 1896, the latter year being, so far as I can gather, the first in which antipyrine was separately classified. The values given for aniline and coal-tar colours are *exclusive* of alizarine and indigo.

German Exports of	1902. Total.	1902. To England.	1896. Total.	1896. To England
Aniline and Coal Tar Colours	28,806 tons £4,464,950	6,609 tons £1,024,000	16,233 tons £3,246,600	3,603 t's £720,600
Antipyrine	59.3 tons £40,500	11.7 tons £8,000	14·7 tons £55,600	4·4 tons £16,600
Tannic Acid	764·5 tons £95,550	254·2 tons £31,700	550 tons £66,000	189.9 t's £23,000

From Professor Green's report, embodied in Mr. Tyrer's paper, it would appear that the value of aniline dyes imported into this country, and in the manufacture of which pure methyl or ethyl alcohol is essential, amounts to at least a money value of £200,000. There would thus appear to be in our home trade in these three articles alone an annual money value of £250,000 dependent on cheap and (or) pure alcohol for success. In all three cases the increase in volume of trade is marked, and further Germany relies on England for a large percentage of its trade in these products.

For the many other substances involving the use of alcohol, I am unable to find statistics (with the exception of ethers and collodion, for which Mr. Tyrer has published the German export values), such articles being grouped under such headings as "alcoholic or etheric essences," "alkaloids and their salts," "liquid alcoholic or etheric perfumes," and from these it is impossible to draw any accurate deductions so far as the use of alcohol and ether is involved.

Dr. J. T. Conroy.

14 Dec. 1904.

much as that? I have heard manufacturers say that you cannot empty the contents of one vat into another, without losing 5 per cent.; but of course that is an exaggeration.

3162. Yes, it would be?—I know you cannot do a simple distillation, even with very great care, without losing at least 5 per cent.; and where you have a succession of distillations, the loss will be very near the 25 per cent. that you state.

3163. (*Dr. Thorpe.*) I am afraid that the revenue would be in a very serious condition if that were the fact. I think that when we distil these things, we do not lose 5 per cent. of the alcohol?—There is always an appreciable loss.

Pharmaceutical preparations. Pure duty-free spirit no longer used in Germany.

3164. (*Chairman.*) You are aware, I suppose, that pure spirit is no longer allowed to be used in Germany for these pharmaceutic preparations?—It is simply for home consumption, I believe; but they have a full rebate on export.

3165. Now take antipyrine; that can no longer be made with pure spirit, and I do not know that they get any rebate on the export of it, do you?—That I do not know.

3166. Since the beginning of 1903 the use of absolutely pure spirit in the manufacture of these pharmaceutical preparations in Germany has ceased, and now they must denature in one of three or four ways?—In one of many ways.

3167. I think they have laid down but four for these particular things, though there are many ways for other things certainly. Taking these particular articles that you mention in your *précis*, the alkaloids equalling an export trade from Germany of £650,000, I think you say?—That includes quinine.

3168. Do you suppose that methylated spirit would be unsuitable for that?—That I could not say. I have not had practical experience; but the methylated spirit would certainly have to be very pure. I am told by manufacturing pharmacists that methylated spirit has a knack of leaving substances of evil smell behind it, which cannot be removed except at a higher temperature than would be necessary with absolute alcohol, and that that higher temperature very often leads to a poorer quality of product.

German denaturants for pharmaceutical preparations.

3169. (*Dr. Thorpe.*) Are you aware what denaturing substances actually are used in Germany in connection with pharmaceutical preparations; have you read the German regulations at all?—I have not read the full regulations. I have simply acquired what information I could from the ordinary German periodicals. I have a list of some of the denaturing agents which are used.

3170. Used in connection with what substances?—In connection with the manufacture of celluloid, varnishes and other uses.

3171. I think it would be convenient at this moment to have on the notes exactly the German Regulations. For example, the drugs which have to be used with denatured alcohol are these: agaracine, podophyllin, scammony, guaiacum and jalap resins, as well as other resins and gum resins. The alcohol which is used in the manufacture of aldehyde and paraldehyde; the alcohol which is used for the manufacture of ethyl chloride, bromide and iodide; the alcohol which is used for the manufacture of chloral hydrate; the alcohol which is used for the manufacture of acetic ether, of glucosides, of collodion, of bromide, chloride and iodide of silver, of emulsions of collodion and of pancreatin, of alkaloids, santonin, tannin and salycilic acid and its salts, coal tar colours (including substances used in obtaining them) and intermediate products and chemical preparations not otherwise named which do not retain any spirit when finished, except formic ether, valerianic ether, and butyric ether—in all cases in which alcohol is used for the preparation of these materials, that alcohol must be denatured by one or other of these things, namely, benzol, turpentine, and animal oil. Were you aware of that fact?—I was not aware that only those three things could be used; I have a list here which gives the alcohol denaturants in 1903, and that gives some sixteen, I will not say substances, but sixteen mixtures for denaturing, and these things were classified and applied to twenty particular uses.

3172. (*Mr. Tyrer.*) Is that from a German work?—I have taken this from the German *Die Chemische Industrie*, which is the official journal of the German Chemical Society.

3173. (*Dr. Thorpe.*) I have given you the whole of the denaturants, and the only denaturants, which are applicable to the particular class of substances which we have been talking about, and on which we had a good deal of evidence yesterday?—English manufacturers, I may say, would be only too willing to accept the same denaturing substances which their competitors abroad are under the obligation of using.

Quinine. Alcohol not required for its production.

3174. (*Mr. Tyrer.*) On page 3 of your *précis*, where you refer to quinine and its accompanying alkaloids, atropine and other alkaloids, you state that Germany's export trade in quinine equals £350,000?—That is so, according to the German figures.

3175. That is right enough; but you know, I presume, that there is no necessity whatever to use alcohol in the preparation of quinine?—Is not alcohol used in the preparation of the other alkaloids which usually accompany quinine?

3176. No?—Well, of course, that is not in my branch.

3177. We have had evidence of the fact?—I simply went for my information to Dr. Thorpe's "Dictionary of Applied Chemistry."

3178. (*Dr. Thorpe.*) I am afraid that is getting a little out of date?—It is getting a little old.

3179. (*Mr. Tyrer.*) We had Mr. Howard here and he said that the bark was not treated with alcohol directly. I thought it would be as well for you to know that?—I am very pleased to hear it.

Alcohol for dyeing.

3180. (*Chairman.*) In part of your *précis*, you deal with evidence on behalf of Messrs. Johnson Brothers, who are dyers of Liverpool. In the second paragraph you refer to some "special dyeing process which has its equivalent in the cleaning line, in the dry cleaning line process." Can you tell us anything about that?—I could not tell you. The firm did not go into any detail, but I should imagine that it would be the solution of some suitable dye stuff in alcohol and the evaporation of the alcohol from the dyed fabric. It enables dyeing to be done very rapidly. That is what I gathered from their statement. Beyond that I know nothing.

3181. You do not know what sort of quantity would be used?—No. They told me they could not say themselves. They merely say, "We think there is a great opening for dyeing with alcohol instead of water, and in our business this would mean popularising our particular kind of dyeing to such an extent it that would hardly be possible to give any idea of the amount of such alcohol likely to be used under such circumstances."

Methylated spirit not unsuitable, but too costly.

3182. They go on to add, "Apart from the question of cost, we have no particular objection to using ordinary methylated spirits." Does that mean for this particular process?—For this process, I take it, and for the whole of their work.

3183. Do you gather from that that the question of cost would be a very serious matter?—They gave me to believe so. Of course it was the differential duty that they had in their minds more than anything else when they were speaking of the cost. They want to get alcohol at the price at which it is obtainable in Germany. I believe the price of German spirit has risen lately.

3184. (*Mr. Tyrer.*) Do you happen to know from conversation with Messrs. Johnson Brothers whether this so-called dry-cleaning process is extensively employed in Germany?—That I cannot say: they said nothing about it.

3185. (*Dr. Thorpe.*) Can spirit denatured with petroleum be used?—It is quite unsuitable for their dyeing, I take it.

3186. What is?—The ordinary mineralized spirit.

3187. And they say methylated spirits will not do?—That is what they say.

3188. (*Chairman.*) Because it is too costly?—Apart from the cost, they have no particular objection to using ordinary methylated spirits.

3189. (*Mr. Tyrer.*) Can you find out what they mean when they say, "We consider that if alcohol could be

obtained at a price equivalent to or about that paid in Germany, we might use it extensively in a special dyeing process which has its equivalent in the cleaning line, in the dry cleaning process." After saying that, they proceed to describe what the dry cleaning process will do; and it appears that they want a cheap spirit to help them in their special drying process, which is equivalent, if this means anything at all, to the cleaning process?—"In the method of carrying out," I should say.

3190. Apparently it is not strictly a dyeing process, but may be both a dyeing and a cleaning process?—I think they would clean with the benzine, and then simply dye the cleaned fabrics with alcoholic dyes.

3191. It would be quite as well, however, if they were asked to explain that?—Certainly; and I will put it to them.*

Lacquer and varnish. Cost of methylated spirit a serious matter in face of foreign competition.

3192. (*Chairman.*) Then you have a communication to place before us from Messrs. Goodlass, Wall & Co., Limited, Liverpool. What are they?—They are manufacturers of paints and varnishes. It is a very old established Liverpool firm.

3193. They say: "Methylated spirit is quite suitable for our purposes as a solvent for gums, etc."; but there again they rather object to the price?—That was in case they had to compete with Germany. They say that at the present time they do not feel German competition very much, but if they did meet German competition anywhere, then they would suffer from the present difference in the price of the spirits.

Customs duty on lacquer, etc. Effect of abolition.

3194. They would meet it at their front door, if they were relieved from every sort of burden in connection with alcohol, because then the last remnant of an excuse for an import duty on spirit varnishes would have disappeared?—Yes. That is a thing that I suppose manufacturers are willing to cope with.

3195. Do you think that they have thought of it?—I will not say that the duty upon these manufactured varnishes and so on coming from abroad should be done away with all at once. We ought to be allowed to feel our legs at first and see what our own distillers can do, and at what cost we can manufacture spirit. We must keep our home trade, and do all we can to do that.

3196. Their communication is important as showing that so far as the character of methylated spirit is concerned they have no complaint to make of it, as I understand?—That is so; in fact, I raised the question whether they would prefer turpentine as the denaturing agent, and they said they were quite content with the methylated spirit as at present supplied.

3197. That would be similar to the German denaturant?—Of course the cost of the denaturant in this country is a great expense. It is much more expensive to use 10 per cent. of wood naphtha than a fraction of turpentine.

3198. (*Mr. Tyrer.*) Supposing Messrs. Goodlass, Wall & Co., deliberately said: "Will you allow us to make a varnish with spirit denatured with turpentine or something else which should be approved by the authorities," would that get over the difficulty to an extent?—Yes.

Artificial silk.

3199. (*Chairman.*) Then you have some notes upon artificial silk; have you yourself had anything to do with the manufacture of artificial silk?—I have had nothing to do with it, but I came across articles in the journals upon it, and I made a few notes upon it as being interesting at the present time. At the Besançon Works, where they use the Chardonnet process, they have a capital of 2,000,000 francs, and they made 2,250,000 francs last year. This year the profits were at the rate of much more than half as much again.

3200. We have had a certain amount of evidence upon the subject of the manufacture of artificial silk?—Of course its manufacture involves the use of large quantities of sulphuric acid and of nitric acid; but it also involves the use of large quantities of ether.

Dr. J. T. Conroy.

14 Dec. 1904.

3201. Then you deal with your Company's interest in the matter, which at the present moment is not great, I understand?—It is not great at the present moment.

3202. They deal with heavy chemicals?—The heavy chemicals line is our line almost entirely, but we have recently gone into some of the finer branches.

Alcohol for laboratory purposes.

3203. You did make an application to us, I think, in the early part of this year as regards laboratory work?—Yes.

3204. And that application was refused?—Yes.

3205. Would that really be of importance to you? You have used up to now very little?—Very little indeed.

3206. The duty would represent about £1 per gallon as you get it, I suppose, according to the price you pay?—Yes, that would be so.

3207. If I remember aright from the papers, you have about nine or ten gallons a year, but you would have liked to use more?—Yes, that was simply in the laboratory of the soap works. The soap works get a small quantity of absolute alcohol and a larger quantity of methylated spirit, but they much prefer to use the absolute alcohol right through in place of methylated spirit.

3208. (*Dr. Thorpe.*) Is that in the manufacture or in the laboratory?—That is simply in the laboratory for testing. I did not know that the application had been made until a few weeks ago, when the manager of that particular works told me. It is only a small thing. It is only a matter of £10 added to the laboratory's account in the course of twelve months.

Attitude of the Board of Inland Revenue in this matter.

3209. Of course you quite understand how it is we could not give a concession of that kind. Every laboratory in the kingdom would ask for the same thing. How could we separate the cases?—I do not suppose the cases could be separated.

3210. Therefore we should be distributing duty-free alcohol to hundreds of people in that kind of way without any control?—I think buyers of alcohol, the owners of laboratories and works, would see that it was not used improperly.

3211. (*Chairman.*) Is it not the case that even in a laboratory the majority of the operations can be satisfactorily performed with methylated spirit?—I do not think we ever use it in our laboratory. We always use absolute alcohol or rectified spirits when we want to do any work. We object to introducing any impurities.

3212. For testing purposes, and as a solvent, can you use methylated spirit?—We can do so; and I used it regularly when I was a student, because I could not afford to pay for the pure alcohol; but I got shocking messes from mineralized spirit.

Methylated spirit used in Government laboratory.

3213. (*Dr. Thorpe.*) We use methylated spirit in 19-20ths of our operations in which spirit is concerned. We do it deliberately, not because it matters to us, because buying the pure spirit is only taking the money out of one pocket and putting it into the other in our case, but we do it as an example; we do it to show that it is a perfectly feasible process. I can assure you that it does not in the least degree interfere with our operations. Of course the methylated spirit that we use is un-mineralised?—Yes, I understand.

Synthetic fruit essences.

3214. (*Mr. Tyrer.*) To continue the Chairman's examination-in-chief, I see you say, speaking of your own Company, "We also employ various synthetic fruit essences in some branches of our work." Do you mean fruit essences?—No, they are simply things like acetic ether and other ethers of that kind.

3215. (*Dr. Thorpe.*) Do you mean things like jargonelle pear essence?—Yes, I mean articles of that class; I am sorry if I have expressed myself badly.

3216. (*Mr. Tyrer.*) You have synthetic fruit essences, like the jargonelle pear essences, the illustration which has just been given, but in that case you would have no duty to pay?—No, not there. The acetic ether is the one we use the most of, but that is only a small thing. It is not a thing that means dividend or otherwise.

3217. I thought at first when I saw this paragraph that you meant to refer to the synthetic perfumes and

*The Witness subsequently wrote:—

Messrs. Johnson Brothers (Dyers), Limited, write:—"In regard to the improved method of dyeing which we might be able to introduce if we could obtain alcohol sufficiently cheap, we are not definitely aware of any German firm in our business using this process, but, on the other hand, we know that they dye a large number of their goods in a different manner, and consequently we surmise that such goods are dyed either by this special process, or some similar process. Of course we have very little opportunity of knowing what our competitors do on the Continent, as we have no friends amongst them, and they never visit us, and, on the other hand, will not permit us to visit them."

Dr. J. T. Conroy.

14 Dec. 1904.

were thinking of them in connection with soap ?—No, that paragraph has nothing whatever to do with soap.

3218. Do you make perfumed soaps ?—Yes, we do.

3219. Do you buy your perfumes of English manufacturers ?—I could not tell you that.

Chloroform made from acetone. Use of spirit for keeping.

3220. You proceed, " As manufacturers of chloroform we use a certain quantity of alcohol." Is any spirit used now in the manufacture of chloroform ?—Chloroform always wants a little spirit to help it keep. There is always a half per cent. in it in England, and up to 1 per cent. in Germany. If the chloroform is not made from spirit, naturally spirit has to be added to it.

3221. (*Dr. Thorpe.*) Do you make it yourselves from acetone ?—Yes, we make it ourselves from acetone, and we add the pure alcohol to it. We have competed with Germany for some foreign orders, and we have got the orders ; but the duty places us at a disadvantage to the extent of that 1 per cent. of alcohol.

3222. (*Mr. Tyrer.*) In this connection it is very important, if it is the fact, to know that chloroform is made from acetone, because then the question arises, where are we disadvantaged in our exportation price ?—It is not all made from acetone. I believe up in the North, in Scotland, a great deal is made from pure alcohol, and a great deal also from methylated spirit.

3223. (*Dr. Thorpe.*) Do you export chloroform ?—We have done so.

3224. Do you get a rebate upon it ?—No. I believe that according to Mr. Tyrer's paper a rebate is not granted.

Manufacture of acetone.

3225. Where do you get your acetone from ?—We get it from acetate of lime which comes from North America.

3226. You make it ?—We do not make the acetate of lime, but we do make our own acetone. Most of the acetate we employ is American. We have used some of the Continental acetate and we have also used some English acetate, or rather Welsh, I believe.

Chloral hydrate. Profitable manufacture with methylated spirit not considered possible.

3227. (*Mr. Tyrer.*) Then you say your company has been asked to manufacture and supply chloral hydrate and ethyl chloride. As you have been asked to manufacture chloral hydrate, what are your notions as regards the spirit required in its manufacture ?—Simply we feel that we ought to use pure alcohol, and that we cannot get that free from duty.

3228. Dr. Thorpe upon this very subject has asked several times those witnesses who have referred to it, whether they are aware that chloral hydrate can be made from methylated spirit ; have you made any such experiments ?—I have not made such experiments, but I have been informed that some persons did start to manufacture it with methylated spirit in this country, and failed. I do not know who it was, but that information was given to me.

3229. Do you mean that the firm failed ?—The firm did not fail in business, but they failed in that particular manufacture. It was Mr. Herbert Evans, of Evans, Sons, & Company, who told me ; but I do not know which company tried this manufacture.

3230. What is the insuperable difficulty ? Perpaps you cannot answer this question : Why should the admixture of 10 per cent. of a thing, three-fourths of which is methyl alcohol and about 12 per cent. of which is acetone, interfere with the manufacture of chloral hydrate from alcohol ?—It is rather difficult to say. Of course, acetone itself gives a number of very complicated chlorine derivatives.

3231. At the maximum there are only 12 grammes of acetone per 100, that is to say there is less as a maximum quantity than 1 per cent. of acetone in the spirit you use ?—Yes ; but still it takes a very faint trace, less than $\frac{1}{100}$th per cent. of certain impurities to absolutely ruin certain products.

3232. Chloral hydrate is crystallized eventually, is it not ?—Yes.

3233. The crude chloral is converted into the hydrate by the addition of water, and then it is crystallized ?—Yes. It might require further crystallization.

3234. Possibly ?—Re-crystallization is very expensive.

3235. The company, I understand, say that it could not be done ?—Not to make money out of it. I will not say that it could not be done in order to get the product, but it could not be done so as to make money out of it.

3236. That is another matter. I understood there was some insuperable difficulty, not of the commercial order, but an actual positive chemical difficulty in the transformation of methylated spirit into chloral ?—About that I do not know.

3237. Is it that you have heard something, but you have not any knowledge ?—I have had no details given to me but simply the statement which you find in my *précis*. If another crystallization is necessary, that would put us at a big disadvantage, because crystallizing is an expensive operation.

3238. (*Dr. Thorpe.*) Yes ; that is another matter ?—Our point here is simply that we wish to make money out of the use of those things, and we wish to be placed absolutely on a level with our competitors abroad.

3239. (*Mr. Tyrer.*) And that you would be at the present moment, if there were no surtax ?—We would be if there were not the surtax, and if we were allowed to use as wide a range of denaturants.

3240. (*Mr. Nicholson.*) You are on a level with your competitors at the present time as far as alcohol is concerned—without having regard to the surtax ?—At the present time, yes ; but only for the moment, I think.

3241. Indeed you have the advantage in the question of the price of alcohol at the present moment ?—When the surtax is put on ?

Alcohol cheaper in England than in Germany present time.

3242. No, disregarding the surtax ?—Do you mean to say that alcohol is cheaper at the present moment in England than alcohol is in Germany ?

3243. It is cheaper than the spirit which is sent from Germany here ?—When the 5d. has been added to it ?

3244. No, without the 5d. ?—I was not aware of that.

3245. (*Dr. Thorpe.*) Do you know that, actually, if it were not for the tariff rate in Germany, it would pay you to export alcohol from England to Germany ?—No ; that I did not know. That is a state of affairs which has only arisen recently—within the last two or three months.

3246. (*Mr. Nicholson.*) As a matter of fact, it is now being exported from England into the free port of Hamburg ?—I am very glad to hear it.

3247. So that as far as the present time is concerned, you have no complaint to make against your German competitor on the score of the alcohol disabilities ?—No ; but we would like to be sure that the present state of affairs would last.

Artificial conditions of German alcohol market.

3248. You are aware, of course, that the production of alcohol in Germany is what might be termed entirely an artificial one ?—Yes.

3249. You could hardly hope to be put on the same footing as your German competitor in that respect, unless we adcpted the same artificial position here ; is that not so ?—I do not suppose we ever could be in exactly the same position ; but I mean that the restrictions should not be heavier on us than they are on the Germans in Germany. It is simply the restriction on manufacturing the spirit and on its uses, I take it, that we are suffering from.

3250. You raise all sorts of questions. The duty on spirit in Germany is very low as compared with the duty on spirit here, and the restrictions here are more severe than the restrictions in Germany ?—They should not be, I take it, for manufacturing purposes.

3251. Not if you want to protect the revenue ?—The revenue must be protected, but we say that some means could be devised for protecting it.

3252. (*Dr. Thorpe.*) That is the object of this Committee ; that is what we are all trying to see our way to ?—Yes, I understand.

High duty on alcohol in this country entails correspondingly stringent Excise restrictions.

3253. (*Mr. Nicholson.*) If you want to protect a very large sum of money on the one hand and a very small sum of money on the other, in the one case you will want to adopt very much more severe restrictions, or very much greater protection, than you will want to adopt in the other, surely ?—Yes.

3254. You have so repeatedly said in your *précis* " If we could only be placed in the same position as our foreign competitors with regard to the price of alcohol," that it

becomes necessary to ask you whether you understand the conditions under which German alcohol is made?—I have taken most of my information on that subject from Mr. Tyrer's papers. I have taken the cost and the selling price of alcohol abroad from his papers, and the selling price as given in England.

3255. (*Mr. Tyrer.*) The greater part of that information is nearly two years old?—Yes, of course it is old now. I have seen that they have a wide range of denaturing agents in Germany.

3256. And in France?—And in France and in Austria; they have even a good number in Russia now, and in Italy too, I believe

3257. (*Mr. Nicholson.*) Let me put it in this way. You have frequently requested in your *précis* that you should be put on the same terms as Germany; I presume that you disclaim any request for assistance of that nature at the expense of the distilling industry in this country?—Certainly. I no not want to hurt any industry. Still, if the distillers could arrange together to start a special works for manufacturing this high strength alcohol, each putting so much money into it, and that works could be put under special supervision—that is, a supervision distinct from the supervision given to the ordinary distillation of whiskies and so on—I think that it might be done. I do not want any individual distiller, or distillers collectively, to be hurt in any way.

Manufacture of industrial alcohol under special conditions suggested.

3258. (*Mr. Tyrer.*) What strength of spirit have you in your mind?—For making 95 per cent.

3259. That is a common thing?—Then say to make 100 per cent., or as near to it as they can get.

3260. (*Mr. Nicholson.*) There is no difficulty about obtaining the 95 per cent?—Of course the users of such would want to be free to distil and re-distil the stuff in their own works; they would have to recover.

Protection of recovered spirit.

3261. (*Mr. Tyrer.*) Under supervision?—Under reasonable supervision, all their spirit being accounted for and redenatured.

3262. Taking any one of these cases which you have inquired about to some extent, what sort of supervision is in your mind?—I suppose that some sort of lock-up store would have to be kept, and sealed spirit would have to be delivered to that store, and it would not be opened except in the presence of some officer; then after it was opened and denatured, the manufacturer would be free to use it, that is to say, it would go into another department, and the manufacturer could use it or not, all at once or intermittently, just as he wished. All recovered spirit, I suppose, would have to go into perhaps the same lock-up room.

3263. Or into a lock-up receiver?—Yes, and be measured and again denatured. I do not think any manufacturer would object to reasonable supervision.

3264. (*Dr. Thorpe.*) To some extent the question of denaturants arises there. You say that it must be denatured; what do you mean exactly by denaturing?—I suppose, rendered unpotable.

Necessity for Excise restrictions discussed.

3265. Let us come to business. Take the case, for example, of ethyl chloride, which you mentioned your company are not in a position now to make?—I suppose the passing of hydrochloric acid into the alcohol would be sufficient there.

3266. Is that a sufficient sort of denaturant to make it reasonably safe?—I should think so.

3267. Why?—Of course it helps in the manufacture of the ethyl chloride.

3268. Supposing you were to add a little caustic soda to that, what would happen?—I suppose you could regenerate the alcohol again?

3269. That is the whole point?—Would any self-respecting manufacturer or any manufacturer in a big way of business do things like that? Would he allow his workmen to do it? A manufacturer who understood his business would not be doing any of these silly tricks; he would not think of them for a moment.

3270. There might be a considerable leakage of spirit, and then that spirit could be manipulated so as to become potable?—I think the manufacturer would take every precaution to ensure that there should be no such leakage.

3271. Of course you look at it solely from the point of view of an officer of the United Alkali Company, a firm who have a reputation to maintain; but we have got to look to all and sundry who come to us for these privileges. They might be anybody; they might set up a works ostensibly to make certain things, but really in order to get the control of large quantities of spirit?—I think if anything fishy went on, it would very quickly be found out.

3272. That is our only safeguard, of course?—You can see the nature of their business, you can see what they sell, and you can have a good idea as to what quantity of spirits they ought to consume. If they are consuming ten times the quantity that would correspond to the product they turn out, then there is room for inquiry.

3273-4. There is; but still these things go on?—Yes.

3275. Illicit distillation still goes on and we cannot stop it. It is not very serious, but now and again, in spite of all our care, we are surprised to find that somebody in the East End of London or in the South of London has set up a still and is making a considerable quantity of illicit spirit?—What sort of people are those? Are they people who would earn their living in any respectable way otherwise? They are simply rogues, take them from start to finish; they are men of that class.

3276. (*Mr. Nicholson.*) You must remember that the Excise authorities have to take the weakest link in the chain, and to base their precautions on that weakest link?—Yes, of course.

3277. (*Dr. Thorpe.*) We individually are in that position here in London—we are all policed everywhere, although we do not pick pockets, and although we do not knock people about in the streets, or do anything of that sort, yet we cannot walk along the length of the Strand without finding half-a-dozen policemen. You might say, why do we want these policemen?—We have them for our own protection.

3278. We do not entertain the idea of doing anything wrong?—I think it would be a very mistaken policy if these privileges were fettered by unnecessary restrictions.

3279. The Exciseman, like the policeman, is for the protection of the community, for he has got to protect the revenue on which the community hangs together?—The so-much per gallon which he gets from alcoholic liquids does not form the whole source of the revenue of the country. If we have industries going and the people are busy, the direct taxation produces more because of the improvement in the general trade of the country—occupations right and left improve all round.

Finance Act, 1902. Its utility to manufacturers not generally realised.

3280. (*Mr. Tyrer.*) I am very much with you from a technological point of view; but I am bound to say that nobody should ignore their responsibility to the revenue officials, especially in this very room. On the other hand, are you aware how much the Act of 1902 really does for the manufacturers? Has it been utilised to the extent to which it might have been?—I take it that it ought to improve the position a great deal. Most of the manufacturers have been asking and agitating for this for a long time past. It is the differential duty that is the main thing.

3281. Are you aware that it is a positive fact—and I think it is only fair to say that I have only learnt it since I have attended this Committee—that comparatively few manufacturers understand that if they were to ask for the benefit of the Act of 1902—I will not say that they would immediately have it, but that no insuperable difficulties have been placed in the way of those who have asked and put plainly before the authorities the conditions, and, in fact, their wants, and that therefore the assumption would be that no insuperable difficulties would be placed in the way of others?—No, I was not aware of that. Before I came into this room to day I was very agreeably surprised to hear from Mr. Leitch that he was allowed to use a portion of his finished product, or a similar substance to that which he was working upon, as his denaturing agent. That is the sort of thing we want, and I was very delighted to hear that it had been granted in his case.

3282. As I have said, I sympathise intensely with the manufacturers—in fact, nothing will remove my

Dr. J. T Conroy.
14 Dec. 1904.

sympathy and intention to do the best I can for manufacturers and for my own business in regard to the use of duty-free alcohol. But I am bound to say that I have been surprised to hear since I came into this room, how few indeed have asked for the facilities which the Act of 1902 gives; and I take this opportunity of saying that I feel quite sure, notwithstanding what you may think of the rather severe cross-examination, that the object of this cross-examination is to learn the views of those who think and who may have a real grievance, and that the cross-examination should be not understood as being in opposition to the general feeling. On the contrary, the spirit in which to-day at any rate—whatever may have been the case in the past—this Act of 1902 is administered, is in a wide, broad and liberal spirit?—I am very glad to hear it.

3283. I felt quite sure from one or two of your observations that you did not quite apprehend that fact?—We have made no applications under the Act beyond the small one for duty-free alcohol for laboratory use.

3284. In one part of your *précis* you say that it is the intention of your Company to consider its position with regard to the productions, whatever they may be, into the composition of which alcohol enters or is a necessary part of the manufacture; and from that point of view I would simply remind you that there is nothing in the world to prevent you putting your case before the authorities?—Thank you for reminding me.

3285. As regards ethyl chloride, the same remark applies, does it not?—Yes, certainly.

Ethyl choride. Suggestion that cost of methylated spirit might be no greater than cost of Excise restrictions if made with pure spirit.

3286. (*Dr. Thorpe.*) Assuming that the Board were asked to extend, as we have powers to extend under the Act of 1902, the privilege to your company to make ethyl chloride from pure spirit, but we said, you can make ethyl chloride from methylated spirit, what would your answer be to that? What is the difficulty in making ethyl chloride from methylated spirit?—I suppose you would get a certain quantity of methyl chloride which is not wanted for your purpose; and even if we can remove that——

3287. Methyl chloride is a gas at ordinary temperatures, is it not?—Yes.

3288. Ethyl chloride is a liquid which boils at twelve degrees Centigrade?—Yes.

3289. There is absolutely no difficulty whatever therefore in making substantially pure ethyl chloride with methylated spirit?—No, except that we have paid for 10 per cent of a matter which we do not want. Unless we could condense the whole of that methyl chloride and could utilise it in some way, we should be at a loss on that; and that 10 per cent. would be the more expensive constituent of our methylated spirit.

3290. I will put a hypothetical case. You must either make it from something which at present exists, or you must adopt some other denaturant, or you must be subject to Excise control, for which, of course, you would have to pay?—Yes.

3291. When all this is worked out, is or is not the line of least resistance the manufacture of it from methylated spirit?—That I could not say, without making experiments or having experiments made;

3292. May I take it from you that in your opinion there is no insuperable objection chemically to the manufacturer of it from methylated spirit—I am taking it, of course, apart from the cost?—Apart from the cost, I should say not; but I am speaking off the books there, as I have never tried to make it. I do not see that it could make any difference or that it should debar one.

3293. (*Mr. Tyrer.*) If that is the case, then there is no insuperable objection?—No, I should think not, apart from the cost.

Permanganate of potash. Non-manufacture in United Kingdom.

3294. (*Dr. Thorpe.*) We were told yesterday—what I was personally very much surprised to hear—that the manufacture of permanganate of potash has entirely departed from this country; do you know whether that is so?—That I could not say.

3295. You yourselves do not make it?—We do not make permanganate of potash.

3296. (*Mr. Tyrer.*) You did, did you not?—That I do not know, but I think not. We used to make the bichromate in the old days, and we used to make manganate of soda, but I do not know about the permanganate—it was rather before my time.

3297. I think you had better refresh your memory?—I know the London County Council used to get manganate of soda from us.

Chlorate of potash. Decreasing manufacture in Lancashire

3298. (*Dr. Thorpe.*) Do you make chlorate of potash?—Yes.

3299. Do you make less chlorate of potash than you formerly did?—I think we make much less.

3300. Is that true of Lancashire generally?—I think so.

3301. Where is it being made?—It is nearly all made in Norway and Sweden. A great deal is made in Switzerland.

3302. By what process?—Water power.

3303. Electrolytically?—Yes, by an electrolytic process. A very large quantity is being made in the United States now. The United States was a very big market for chlorate at one time.

3304. Is that being also made electrolytically?—I think without exception. I know there are several works for it. Our Company has a Works in the States, and I know of at least two others making chlorate.

Competing methods of manufacture.

3305. Is electrolytic chlorate made in Lancashire?—I cannot say that it is made in Lancashire, but it is made on the other side of the river at Runcorn in Cheshire, which is practically part of Lancashire. It is made by the Castner-Kellner process.

3306. It is made from steam power as against water power, then?—Yes. It is also made at Middlewich by the Electrolytic Alkali Company. That is done by the Hargreaves process.

3307. That is also steam power, is it not?—It is either steam power or gas engine power, which I believe is now used for the Castner-Kellner process.

3308. Are we to take it that the cost of water power is so cheap that the steam-power-made electrolytic products cannot compete with the water-power-made electrolytic products?—Well, they can and they cannot. I do not suppose than any manufacturer can make the kilowatt hour from coal burnt under steam boilers at less than one-third of a penny; but with water power one can get it for about one-tenth of a penny—that is to say, it costs to generate by steam three times as much. But very often again the manufacturer who uses steam power is in the centre of his market and has no freight to pay. It is nearly always a question of freight and situation.

3309. (*Mr. Tyrer.*) Many people have the impression that the steam power obtained from Mond gas rivals in every respect water power; is that correct?—I should doubt it. It undoubtedly has a very great advantage over the ordinary steam power. I believe you get somewhere about three times the efficiency from the Mond gas when you ignite it in a gas engine, to what you get from it when you burn it under boilers—for steam.

3310. In specially constructed engines, that is?—Yes; but of course you only get somewhere about 80 per cent. of your fuel energy in the form of gas and have to recover your ammonia. If the ammonia market is good, and if you are working a fuel rich in nitrogen, you can make a very good thing out of your ammonium sulphate, and that may bring down the cost of your power to the equivalent of water power.

3311. (*Dr. Thorpe.*) Is there much chlorate of potash imported into this country from Norway and Sweden?—I should hardly think so, but I would not like to be certain on that.

3312. I am supposing that the reasons why that particular industry has centred, we will say in Norway, are first the water power, and next, that they are close to their market, where they use it in the manufacture of lucifer matches?—Yes.

3313. Presumably the greater portion that is made is consumed, we may say, on the spot; is that so, or is it not?—No, a very great deal of it goes to Germany.

3314. For the same use?—For the same use, and for manufacturing explosives. There is, for instance, a great deal which is made—I suppose about the boundaries of France and Switzerland—from water power, and which is used in the Cheddite explosives. Germany also uses a great deal in the organic dye

industry, I think, as an oxidizing agent, and then a certain amount is used in match-making.

3315. The amount made in Norway or Sweden by water power is more than sufficient, is it, for those demands which you have mentioned, and therefore some comes in here?—I will not say the amount made in Norway and Sweden alone, but in Norway, Sweden and Switzerland or in Southern France there is more than sufficient made to cover the home consumption, I think. I daresay some will find its way here, but I do not think it will be any very appreciable quantity.

3316. How does our lucifer match maker get it; where does he get it from?—I suppose he buys it very largely from the United Alkali Company. We have very large chlorate works in Widnes.

Manganese. Increasing importation into Germany.

3317. So you can compete with this Norwegian product?—Yes, at home. Reverting to permanganate, I have some figures which show that the Germans are importing increasingly great quantities of manganese ore. In 1892 they imported £38,000 worth and last year they imported £400,000 worth. A great deal of that will undoubtedly be used up, I should say, in the manufacture of permanganate. I think it is nearly all done electrolytically. They make nearly all their potash by electrolysis, and they get very large quantities of chlorine or bleach from that.

3318. Surely such an increased quantity of manganese as that cannot be accounted for in the permanganate of potash; the world does not demand that amount of permanganate of potash?—I will not say it all goes for that, but those figures show the increasingly great quantities that are being taken over there, and they also possibly show where the market for permanganate has gone to.

Dr. J. T. Conroy. 14 Dec. 1904.

3319. The manganese is not used for Leclanché cells and things of that sort, is it?—Do you mean MnO_2?

3320. Yes?—That may be.

3321-2. With regard to the heavy chemical trade and the coal-tar dye business, we have heard witnesses specifically upon that, and it has been threshed out in various quarters. I see that on page 16 of your *precis* you urge that the whole thing turns upon the relative position of alcohol with regard to these dyes, and that therefore if the dyes came here, sulphuric acid, hydrochloric acid, caustic soda, bichromate and permanganate would be required; but you yourself have mentioned that the need for permanganate exists here to-day, quite apart from any question of the aniline dyes?—Yes. Even taking a 20 per cent. basis as the cost of the heavy chemicals involved in the manufacture of aniline, that would give the value of the heavy chemicals used in the dye industry in Germany as being nearly £1,250,000. I think 20 per cent. is a low estimate for making aniline; the cost is at least 40 per cent. on the selling price of the aniline; and if you add the nitrite in order to diazotise it, that would bring it up to 60 per cent, but of course here a product of higher price has been reached.

ELEVENTH DAY.

Tuesday, 20th December, 1904.

PRESENT:

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair.*)

Professor Sir WILLIAM CROOKES, F.R.S.
Sir W. H. HOLLAND, M.P.
The Hon. J. SCOTT-MONTAGU, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*).

Mr. JOSEPH JAMES GITTINGS, called; and Examined.

3323. (*Chairman.*) You are the managing director of Gittings, Hills,& Boothby, Limited, are you not?—I am.

Mr. J. J. Gittings. 20 Dec. 1904.

3324. They are manufacturers of varnish and lacquer in Birmingham?—Yes.

Spirit varnish and lacquer. Decline of foreign trade.

3325. What proportion of your business relates to spirit varnish and lacquer?—Ours is a decreasing consumption of spirit. I was looking at the figures the other day, and I found that we were at one time using about 400 gallons per week; but the amount has now fallen off very considerably. The foreign trade is, of course, answerable for a good deal of that.

3326. When you speak of the foreign trade being answerable for a good deal of that, do you mean that your foreign trade is less than it used to be?—Yes, it is very much less.

Methylated spirit. Objections as regards cost.

3327. Is the spirit that you use the ordinary methylated spirit with 10 per cent. of wood naphtha in it?—Yes, 64 O.P.

3328. Do you occasionally use absolutely pure spirit on which you have paid the duty?—Very seldom. It is only for experimental purposes, or for perhaps making a gallon or so, where it is specified to be made with pure spirit. We do not use it otherwise.

3329. The objections you take to the methylated spirit are, first the cost, which is greater than that of pure spirit?—Yes.

3330. Then, as regards its character and its suitability for the work that you wish to do?—Yes.

3331. As I understand, methylated spirit has disadvantages as compared with pure spirit?—Yes. May I put in some figures as to the price?

Objections as regards character.

3332. I think as regards prices that it is hardly necessary to labour that, because it is admitted that there is an extra price for methylated spirit; and it must be so. Now as regards the character of the spirit for your particular manufacture, what are the faults that you find with it?—In the first place, a spirit which is denatured with wood naphtha does not dissolve some of the gums so readily; and secondly, the denaturant, whatever is put into it, tends to produce an iridescence in some of the things that are made. That does not happen with varnishes, such as Patent Knotting or black varnishes for bicycles, or any of those varnishes that are used for wood work (for instance, for laths for bedsteads), but it does happen with lacquers.

The German denaturants for making lacquer. (*See* also Q 3362).

3333. And you consider yourselves at a disadvantage with the German maker by reason of the fact that he can use, not pure spirit, but a purer spirit than you can?—He can use a spirit that is very much purer. I have stated in my *précis* that they are allowed to denature spirit in Germany by the addition of one-fourth of 1 per cent. of shellac. As varnish and lacquer manufacturers, that would suit us admirably, because we have to put

Mr. J. J. Gittings.

20 Dec. 1904.

shellac into almost every spirit varnish that we make. Shellac would do, therefore, for us.

3334. You state that a very small amount of shellac is permitted, but I do not find that in the Printed Regulations?—Have you the authority that I give, namely, Dammer's *Chemische Technologie*, volume 3, page 584?

3335. No, but we have the German official regulations as they at present stand?—I have not seen those.

3336. (*Mr. Tyrer.*) Do you know the date of the publication of the work to which you have referred as an authority?—No, I do not know the date of it, but we have it at our Chamber of Commerce at Birmingham. It was shown to me the other day.

3337. It has not been published within the last three or four years, probably?—I believe it has, but I think another witness, Mr. Cocking, will be able to speak more positively on that subject than I can.

3338. (*Chairman.*) According to the German official regulations as they at present stand, there are alternative methods of denaturing. The first alternative is two litres of wood spirit and two litres of petroleum benzine toe very hectolitre; the second, half a litre of turpentine —that is, ½ of 1 per cent. of turpentine; and the third, 5 per cent. of wood naphtha. The method which is practically used in Germany to the largest extent is the method of denaturing with ½ of 1 per cent. of turpentine; then the next commonest method is denaturing with 5 per cent. of wood naphtha, which uses about half the quantity of spirit that the turpentine method of denaturing represents. How about the ½ of 1 per cent. of turpentine; would that suit you?—That would, I think, be preferable to 5 per cent. of wood naphtha; but the addition of any quantity of turpentine would make the gums very much less soluble. Gums that are soluble in spirits of wine are not, as a rule, soluble in turpentine.

3339. Then do you think that the turpentine method of denaturing is not very suitable for the manufacture of lacquers and varnishes?—I should think it is more suitable than 5 per cent. of wood naphtha, but I would sooner have the pure spirit.

3340. The important point is that neither in Germany nor in any other country in the world is pure spirit allowed to be used?—The denaturing with shellac is better than all those three that you have mentioned.

3341. It would be, perhaps, if it were allowed, but I cannot make out that it is allowed in Germany. For the purpose of lacquers and varnishes generally, you may say that the Germans use one of two methods—either ½ of 1 per cent. of turpentine or 5 per cent. of wood naphtha?—Our experience in competition with the Germans does not lead me to think that they use either of those. It leads me to think they use the spirit denatured with a little shellac.

3342. You cannot argue from your experience, surely, as against the official regulations in Germany?—Unfortunately I did not know this was coming up some time ago; otherwise we could have kept the test. We had some German lacquer sent us from our agent in Spain. He said ours would not do, and that none of the English lacquer would do. We went into it very fully with him after a bit. He kept writing us, saying it was a shame for him to have to order German lacquer when he was the representative of an English lacquer firm. When he sent the lacquer over to us, Mr. Hills, one of our partners, who is a chemist, tested it, and he found that the spirit that was used in it was practically pure. Of course, we could not tell the quantity of shellac in it, beyond saying that there would be an additional quantity of shellac.

Import duty on lacquers. Its abolition not considered a serious matter if pure duty-free could be used in this country.

3343. You may take it that, as a matter of fact, your German competitor does have to denature and does denature in one of those two ways. Let us assume for a moment that you would be permitted to use absolutely pure spirit and to put nothing in except, say, shellac—which you would put in in any case probably?—Yes.

3344. Therefore that practically would come to this—that you would be using pure spirit?—Yes.

3345. What justification would remain then for any import duty upon lacquer or varnish coming into this country?—I did not know that there was an import duty.

3346. All imported lacquers and varnishes are charged according to the quantity of spirit that is in them. Do you not know that?—Yes, I remember that now.

3347. The corollary of giving you free spirit would be to free all varnish and lacquer, whether imported or whether made in this country, from any duty of any sort or kind, would it not?—I do not think that would trouble us much.

3348. That would open this market to the German lacquer, which your correspondent in Spain said was so much better than yours that he must order it instead of yours, as I understand?—Yes.

3349. Would that not be rather a risk for you?—The position as far as we are concerned is that we think we should get as good a lacquer as the Germans do, if we could use the same spirit. If I were asked my candid opinion, I think that in the methylating some moisture gets in. I do not know whether it is possible, but I think that wood naphtha is miscible with water, in which case it would give these rainbows when it is mixed. If that is the case, of course that would account for it. What we want to do away with is the reproach that we cannot make it as well as the Germans.

Specimens of lacquer work. (*See also* Q. 2961).

3350. Would you point out in those specimens the iridescence, if there is any iridescence in any one of them (*handing three specimens to witness. See Q.* 1842)?—There is very little to choose between these.

3351. One of these is made with pure spirit; could you pick out the one which is made with pure spirit?—(*After examining specimens at the window.*) I should say that *that* is made from the pure spirit.

3352. Which is the least good?—*This* is the least good, certainly. These two are very much alike, but I should give the preference to *that*. If you see them one by one like these, there is very little difference apparent, but if you were to see them in a mass, there would be a very much greater disparity between them.

3353. These were brought by a gentleman from Birmingham to illustrate the advantages of pure spirit. You seem to have picked out as the best the one that is lacquered with a methylated spirit lacquer, and as the least good of all the one that is lacquered with a pure spirit lacquer?—I should not have thought that they would have tested them in this way. I should have thought that they would have put the lacquer on a big round tube instead of on these little things.

3354. (*Mr. Scott-Montagu.*) What you mean to say is that in a big mass, such as a lot of bedsteads put close together, you would be able to see the difference very easily, but you cannot see it on those small things?—Yes, that is so. A big pillar of a bedstead would be preferable to these things. These are what we call mounts.

3355. It really does make a difference when you see it in a big mass, although it is not easy to see the difference in those?—That is so. It is difficult to choose between these.

3356. (*Mr. Tyrer.*) There is so much shaping about those, and there are so many shadows that it is perhaps scarcely fair to take them as test specimens?—A big tube would show it very much better than these things, which are very little guide.

Turpentine as a denaturant.

3357. Might I ask, in reference to your remark about turpentine, whether you have tried a lacquer with so small a percentage of turpentine as the Germans are allowed to use?—We did some time ago, but it was not with a quarter of 1 per cent. Unfortunately we tried it in too large a quantity; we tried it with 1 per cent., and it did not answer at all.

3358. Age is an essential characteristic of varnishes, is it not?—Yes.

3359. So it would not be a fair test to make between now and the end of the year varnishes with ordinary spirit denatured in the proportions indicated by the German requirements?—No, that would not be a fair test. It wants at least three months' maturity.

3360. You have said that you objected to the use of turpentine, but now that you know it is only used in so small a quantity, have you any objection to it?—Certainly I should prefer a quarter of 1 per cent. of turpentine to 5 per cent. of wood naphtha.

German regulations as to lacquer for sale.

3361. (*Chairman.*) The German regulations require half of 1 per cent. and not a quarter of 1 per cent. of turpentine?—Even half of one per cent. of turpentine I should certainly prefer, as a varnish manufacturer, to 5 per cent. of wood naphtha.

3362. (*Dr. Thorpe.*) May I point out that that concession is only given to places where the article is consumed in the works, and that all lacquer made in Germany for sale must contain 5 per cent. of wood naphtha and 10 per cent. of shellac, or other resin, in addition to the wood naphtha?—I was not aware of that, but we could do with the shellac.

3363. (*Chairman.*) You are lacquer manufacturers for sale, are you not?—Yes; we do not use the lacquer ourselves. The 10 per cent. of shellac is a very large amount, but I do not know that there would be any objection to that on the part of varnish manufacturers. It is the wood naphtha we object to. I take it that you are quoting from an authority that I cannot question, but all the same our experience in competition with them teaches us that it is not so.

3364. Your difficulties in competition apparently come from something else, and therefore you ought now to find out what they are due to; they are clearly not due to the wood naphtha?—It may be that the Germans use a different kind of wood naphtha. I have thought of that myself. Certainly when Mr. Hills tested the sample that we got from Spain of a German lacquer, he found that there was no naphtha in it.

See post Qs. 3431-2

3365. Can you say what proportion of your total output is sold in the home market and what proportion is exported?—It is nearly all sold in the home market now. We export very little; it has been driven out.

Import duty. (*See ante* Qs. 3343-9.)

3366. Seriously, do you say that it would not be an alarming thing to you that the home market should be opened to all manufacturers of lacquer and varnish, without any import duty at all being imposed?—We should not mind that, if we had the spirit duty free, because all we want is fair play. When we compete wtth them in neutral markets now we are under a serious disadvantage.

3367. If you are in serious danger in the neutral market, why are you not going to be at a disadvantage also in the home market; that is what I cannot understand?—We should be getting the spirit at a lower price.

Price of spirit in certain places abroad

3368. Not much, only a little?—This is taken from the U.S.A. Department of Commerce and Labour Bureau of Statistics, No. 288, Monthly Consular Reports, September, 1904, page 30, from H. G. Squiers, U.S.A. Minister, Cuba, Havanna. Under date August 20th, 1904, he writes: "As alcohol is very cheap here, 10 cents a gallon." Then here is another, No. 287, Monthly Consular Reports, August 1904, page 143, from R. P. Skinner, Consul-General, Marseilles. Writing on 17th June, 1904, he says: "To have a chance in this market the price must be 35 francs, c.i.f., per hectolitre of 27 gallons, less 6 per cent." That is about 1s. per gallon. We have ourselves obtained it in Spain for 1 peseta 50 centimos.

3369. Are you talking now of the lacquer?—No, of spirits of wine.

3370. (*Mr. Tyrer.*) Of what strength?—We could not tell the strength there. It is not perhaps so well rectified as it may be. They are rather backward in Spain in some of those things; and we simply bought it as it was. The result was that it made as good a varnish or as good a lacquer, but at the same time it was rather slower in vaporising, owing to the heavier specific gravity.

3371. (*Mr. Nicholson.*) Can you tell us the equivalent in English money of the Spanish price?—1 peseta then was worth 7d., so that 1 peseta fifty centimos would be worth 10½d.

3372. (*Dr. Thorpe.*) Is that 10½d. per bulk gallon?—I think it was for five litres, which is a trifle over a gallon. That is how they reckon it in Spain.

3373. (*Mr. Scott-Montagu.*) The cheapest you have quoted is Cuba?—Yes, that is about 6d.

3374. (*Dr. Thorpe.*) That is alcohol made from waste fruits, is it not?—In Spain, do you mean?

3375. Or in Cuba?—I suppose it would be.

3376. It is made from bad fruit that they cannot do otherwise with. I know that in the West Indian islands, which are not under us, and in the Azores, they make large quantities of alcohol from peaches, apricots and things of that kind; that is the sort of alcohol you mean, is it not?—Yes.

Mr. J. J. Gittings. 20 Dec. 1904.

3377. (*Mr. Tyrer.*) What have you found is the weakest spirit which will dissolve the least soluble of the gums that you use for lacquers?—We have never tried any spirit below 61 O.P.

Use of pure spirit for making insulation varnish.

3378. I have been making some experiments upon that point in connection with electrical insulations?—Occasionally we get orders for electrical varnish, and then we have to use the pure spirit, charging of course a proportionately heavier price for it. The insulation is so much more perfect when using a pure spirit than it is when using anything that has been denatured.

3379. (*Sir William Crookes.*) There is a special insulation varnish, is there not?—Yes. That is a very small proportion of our trade, I may say.

English lacquers cannot compete in neutral markets, either as regards price.

3380. (*Chairman.*) Do you have any objection to the use of methylated spirit for varnishes, as distinct from its use for lacquers?—None, except the price. I was over in Copenhagen two years ago, and I had then to quote against a German firm. I was hopelessly out of it. I was about a shilling per gallon out, which made it absolutely impossible for me to do the business. I heard afterwards—whether it was true or not I do not know—that the pure spirit was being used there.

3381. (*Dr. Thorpe.*) Do you know whether the German exporter gets a rebate on the spirit varnish which he sends out?—I do not know absolutely, but our agent in Spain, who saw their travellers repeatedly, told me that they did, and that that was how they were able to do it.

3382. You mean that they do get a rebate?—Yes, for exporting.

3383. Although they use denatured alcohol, they nevertheless get a rebate when they send spirit varnish out?—Yes. That is what he told us, but of course it is only hearsay evidence.

3384. You were not told by your Copenhagen clients that such was the case?—No. That was a big firm who were making laths for wire mattresses. This stuff is put all the way round on the wood; it is not exactly a lacquer; it is half-way between a lacquer and a varnish; it is not quite thick enough for a varnish, and it is rather too thick for a lacquer. They told me that their difficulty was that they had never been able to get anybody to touch the Germans in price. Their representative could speak English very well, and he told me that the reason was that we could not get the spirit cheap enough. That was about two years ago.

3385. Was that difference in price because of the rebate or was it because of the initial cost of the spirit?—That I did not learn from him. I have only heard that from our own traveller in Spain.

or as regards quality.

English and German lacquers in Spain.

3386. What did you learn from your own traveller in Spain?—I have a lot of letters from him; perhaps I might read a few paragraphs. In a letter dated October 1, 1903, he speaks about this lacquer, and he says: "I am sorry to say the sample jar will not do, and to show you what is amiss I send you per this post two corner plates, one done with your lacquer, and one with German, each marked on its back with its country of origin. Whilst the German sample is not absolutely free from the blue streaks of which I have told you before, it is very nearly so, but yours is quite mottled. Take a sheet of white unlined paper and hold it against the plate"—you will see the same thing happens as in these small specimens you have shown me. He asks us to take a sheet of white unlined paper, and put it against the plate in order to see the difference, because the difference was not very palpable unless you did so—"Take a sheet of white unlined paper and hold it against the plate, between it and the light, and you will see what I refer to. There is apparently no difference between your last sample and what you sent before. Customers insist on German lacquer, and if I employed an inferior quality I should wreck the business. Nevertheless it is hateful that I, representing an English lacquer works, should be obliged myself to use another maker's. I trust

Mr. J. J. Gittings.

20 Dec. 1904.

you will soon make that necessity disappear, even if you have to raise the price considerably. I understand that a big Birmingham firm have lost their French trade for precisely the same reason, but they only pay 3s. 6d. per gallon, and so cannot grumble."

3387. (*Chairman.*) What is that which is 3s. 6d. per gallon?—That is a very cheap lacquer something like the lacquers put on these specimens. The quality of lacquer used for these specimens is not reckoned the best lacquer. The best lacquer would be used on such things as chandeliers, which have to be exposed for a long time and are only cleaned periodically. Then, on the 26th of November, he says:—"Are you going to try to match the German lacquer I sent you? It goes against the grain terribly to order in Germany, but if you won't supply me with the right article I have no option."

3388. Your correspondent is a user of lacquer, is he?—Yes, he is a user as well; and he was selling it for us. He was losing his trade in selling the English lacquer, and he was compelled to use the German lacquer himself in his own place, although he was our own agent. Writing on January 20, 1904, he says—"I have now made the experiments I mentioned, but cannot get rid of the rainbows. The first thing I noticed when I got to work was that your lacquer was of the proper density according to the note of the German maker, namely, 880 grammes per litre. This left me at sea; because supposing the defect would be in that, and that I should merely have to reduce the spirit by evaporation, I imagined I had an easy job on. By way of experiment I took two litres and reduced the weight of the first to 850 grammes, and the second to 835 grammes, reducing the bulk naturally in the same proportion."

3389. (*Dr. Thorpe.*) How? With what?—He reduced them by evaporation. "There is no material difference in the effect of the two litres as both leave a mottled appearance, but the lacquerer told me the second was too thick for working, by which she meant that it was thick and clogged the brush"—that is from excessive evaporation. "Apparently, therefore, the defect lies elsewhere, I suppose in the imperfect solution of the gums, and recommend you to try some other dissolvent, say, pure instead of methylated spirit, always supposing that you use the best kinds of gum. I send you per this post a sample plaque done with your lacquer Nos. 1 and 2 as above, and one done with German lacquer marked G; I also send you a further sample of the German stuff. A large Birmingham firm tells me that the German mount makers have got a name for finish in their markets that the English cannot approach, but I believe they think anything over 3s. 6d. per gallon is extravagance; still as the Germans are new in the trade, and in the natural course of business will soon be knocking at the gates of Birmingham, the local makers will have to get good lacquer; and I believe it will pay you to keep at it until you hit the right mixture." Then we tested the second sample of the lacquer, and our chemist, Mr. Hills, found that it was pure spirit. It was 8s. per gallon, and then they had to pay the duty in Spain, and as the duty on the English spirit is, I believe, 11s. here in this country, it was evident that it would be impossible to do it with a pure spirit with a duty like that on it.

Loss of Continental trade in English-made lacquers.

3390. (*Mr. Nicholson.*) At present you are not allowed to use pure spirit?—Of course not. If we could have a rebate, it would do a very great deal towards getting back the foreign trade. As far as all the varnish and lacquer makers of England are concerned, without exception they have all lost trade on the Continent. Years ago, if you went to Spain, or France, or Italy, you would see "Vernis Anglais" on every oil and colourman's shop, or the equivalent in their own language.

3391. (*Chairman.*) What was the import rate of duty then, and what is it now?—I cannot answer that.

3392. That is the whole point, is it not?—I know the import rates have gone up.

3393. (*Dr. Thorpe.*) Do they not make these things in Spain—they can get the alcohol relatively cheap there?—No, they are very backward there in manufactures.

3394. Do you tell me that there is none at all made in Spain?—I do not think so. Of course, Spain is a very large country; but in the North of Spain, where the manufactures are mostly carried on, there are no varnish or lacquer manufactures at all.

3395. There is no particular reason why they should not make their own varnish or lacquer, as they can get the alcohol relatively cheap, and I suppose, like you, they would have to import the shellac?—Yes, they would have to import the shellac. What we did was to send Mr. Higgins, our agent there, some shellac, gum benzoin and Manilla copal and various other ingredients, and tell him how to mix them. I went over there. We got some pure spirits of wine, and then we had no further trouble whatever with the rainbows. The article we made was suitable. Mr. Higgins is over in this country now again, but we are making in Spain the lacquers that we want there, and we do not export them from England. As I say, the spirits of wine there is not perhaps of the quality which you get here after you have paid the duty on it, but it suits after all.

Satisfactory results of making lacquer in Spain for Spanish market.

3396. (*Mr. Tyrer.*) It does not contain wood naphtha?—It does not contain any wood naphtha.

3397. (*Mr. Scott-Montagu.*) In reference to the Chairman's question about the import duties, I suppose that the duties are the same in Spain on all lacquer or varnishes coming from all countries, as far as you know?—Yes.

3398. (*Sir W. H. Holland.*) That is, Germany included?—Yes.

3399. So your German competitors there would have to meet the same tariff?—Yes.

3400. (*Chairman.*) If France has put up her duty and keeps our varnish out, therefore, she also keeps out the German varnish?—Yes; it is done to keep up the local industries.

3401. (*Mr. Scott-Montagu.*) There cannot be any difference between Germany and England as regards the Spanish import duties; what difference there is must simply rest on the fact that the German manufacturers can use free alcohol or get a rebate on the alcohol used, which practically comes to the same thing, and that the English manufacturers are not in that position?—Yes. If we have to pay a duty of 11s. to start with, it is practically impossible for us to sell it f.o.b. London to export to Spain at 8s. If the German can buy his pure spirit, or if we, as we do now, can get the spirit in Spain at about 1s. or a little over 1s. per gallon and make the lacquer there, then we can sell it and make a very handsome profit out of it.

3402. So it pays you, in fact, to set up manufacturing in Spain?—Yes, that is practically it.

3403. But you consider that it is very desirable in your trade that you should have some further facilities?—Yes, I do; I am very strongly of that opinion.

3404. Because it would materially assist you in your dealings, especially in the markets abroad?—In the neutral markets it would especially.

Import duty. (*See ante* Qs. 3343-9, 3366.)

3405. You do not fear the abolition of what may be called to a certain extent a protective duty here?—Not at all, because to a certain extent we are exposed to that now in the varnish trade. There is no duty upon varnish, and the Americans send in any quantities of varnish.

3406. (*Chairman.*) Not of spirit varnish, do they?—Not of spirit varnish, but they do of other varnishes. We meet that competition cheerfully, but we cannot meet competition in neutral markets either in quality or in price for spirit varnishes.

Suggested drawback on exported lacquer (*See also* Qs. 3473-9.)

3407. (*Mr. Tyrer.*) Have you ever made a calculation on the assumption that you are paying the English price for your spirit, and were under a system of rebate?—No, I have never worked that out.

3408. Do you know with regard to certain preparations of a medicinal character, not for use in the United Kingdom but for exportation, that not only is the full duty given back, but an allowance is made for waste, and the surtax (which you know is 5d. per gallon) is also returned?—Yes.

3409. Have you ever had it suggested that you should make a calculation as to whether, taking the price of English spirit, you would be able to compete with the Germans if you worked under a system of rebate?—No, we have never worked that out. But it would be a very interesting calculation, and it is one that I shall work out now. The fact is, I may say, that pretty well all the varnish manufacturers are in the same predicament—we

have all lost our foreign trade in spirit varnishes, and we are all in the same boat. Until I heard of this inquiry I had no idea that there was anything stirring in the matter. It is a step in the right direction, I am sure of that, because we have steadily lost the foreign trade, and we are bound to go on losing it until it all goes, in my opinion.

3410. (*Mr. Nicholson.*) Does that all depend on the cost of the spirit ?—Partly, and partly because I feel sure there is something wrong in the method of methylating. In my opinion they allow rather too much moisture to get in. I give that only as my opinion, but I am not a scientific man, and I am only going on the numerous tests we have made.

Methylated spirit. The two kinds distinguished

3411. (*Dr. Thorpe.*) Who allows too much moisture to get in ?—The methylators. We have tested samples, and in a good many cases we find that the wood naphtha they put in is miscible with water. Of course there are two kinds of methylated spirit. You may go to an ordinary chemist and get methylated spirit from him, and put some water to it, and you will find it turns cloudy. That cloudiness, that milkiness, shows you the presence of mineral naphtha. We have to be very careful that we do not get any of that, because we cannot do with mineral naphtha at all in making varnishes or lacquers. Mineral naphtha is fatal to our trade. We test every consignment of 200 or 300 gallons we get by the water test to see that it is quite clear. That is the only way we can test it.

3412. You do not methylate yourselves evidently ?—No, we do not.

3413. (*Mr. Tyrer.*) What is the strength of the methylated spirit that you buy ?—Sixty-four over proof. We never buy anything but that.

3414. (*Dr. Thorpe.*) No doubt you deal with firms of repute ; why should they give you mineralised methylated spirit ?—They will not give it, because we will not have it.

3415. They are not likely to give it to you, because, as a matter of fact, it is slightly more expensive to them than the other ?—Indeed, is it ? I did not know that.

3416. Do you know the distinction between the two kinds of methylated spirit ?—No.

3417. It is exactly the same thing in each case, except that the mineralised methylated spirit contains three-eighths of 1 per cent. of petroleum in addition to the wood naphtha ?—But surely petroleum is cheaper than wood naphtha.

3418. The petroleum is used in addition to the wood naphtha. They methylate a large quantity at once, they add the requisite amount of wood naphtha to the alcohol, and then to that portion which is going for retail sale they add three-eighths of 1 per cent. of petroleum ?—That would cheapen it, would it not, to that extent ?

3419. (*Mr. Tyrer.*) It would not cheapen it enough to compensate for the additional trouble ?—I see ; it is the trouble you are looking at.

3420. (*Dr. Thorpe.*) You are not likely, therefore, to get the other, except by an accident ?—We have got it once or twice.

3421. Then it has been by an accident ; it cannot have been by design ?—No doubt that is the explanation.

3422. It has been due to some impurity in the vessels they have been using probably, because they would not do it by design, that would be against all reason ?—Probably that would be so.

Little risk of misuse of pure spirit in making lacquer.

3423. (*Mr. Tyrer.*) In the fourth paragraph of your *precis* you say that you have no doubt that there would be no risk of any of your workpeople drinking the spirit ?—I have no doubt about that at all.

3424. You consider that the amount of supervision in your place would be sufficient, if you were allowed to use a pure spirit or a specially modified spirit. You have not found any tendency, I take it, on the part of your workpeople to carry awey spirit on the one hand, or any spirit varnish on the other, in order to utilise the spirit in any way afterwards, have you ?—No, never.

3425. Have you heard of any such thing ?—No, never.

3426. Not even in the Birmingham district ?—No. I have heard of women drinking French polish, but I should think it would very soon kill them, because the shellac that is in French polish is insoluble in water and would form a coating on the stomach that would soon give trouble.

Mr. J. J. Gittings.

20 Dec. 1904.

3427. (*Sir W. H. Holland.*) Why women instead of men ?—Women polishers are more numerous than men polishers.

3428. You do not suggest that they have a greater thirst on them than men ?—No. There are very few hands employed in making varnishes and lacquers in comparison with the turnover. I am a director of a printing concern where the turnover is £40,000 a year, and where we employ about 300 hands. At our varnish works we turn over considerably more than that—nearly £60,000, and we have only got about sixty hands. In this lacquer and spirit varnish making, one man and a boy can make 1,000 gallons a day. We can make anything we can get orders for by one man and a boy with the apparatus we have.

3429. (*Mr. Tyrer.*) But you have to store it for three months before it is reasonably fit for work ?—Yes ; but so soon as ever it is put into the churn—that is a cylindrical vessel in which it is churned—naturally it gets denatured by the addition of the shellac or other gums which we put in ; so that the risk would only be in decanting it from the cask into the churn or into the vessel in which it is churned up.

3430. (*Dr. Thorpe.*) In the first place, I think you have been misinformed and that you are under some misapprehension with regard to the German varnish makers using pure spirit. They must use a denatured spirit. You are not able to inform us, however, whether on that varnish which they export there is not a rebate given which may account for the effect in neutral markets ?—No, I cannot tell you that.

Wood naphtha as a denaturant in Germany (*see* Q. 3364). Its impurity as compared with the English standard.

3431. You said something about the nature of the wood naphtha in Germany, and you expressed some doubt as to whether there was not some difference in the wood naphtha used in Germany as compared with that used in England ?—Yes.

3432. There is a very considerable difference. The wood naphtha used in Germany is much more impure than the wood naphtha which is used in England, because it contains less methyl alcohol and rather larger quantities of acetones and the other things which are sometimes stigmatised here as impurities. You are not aware of that fact ?—No, I was not aware of it. Does it contain more water ?

3433. It is not the wood naphtha which contains the water. If you are troubled with water, that is much more likely to be in the alcohol than in the wood spirit ?—The wood naphtha we buy ourselves very often is the same that the methylators use, and we always call it miscible wood naphtha because it is miscible in water.

3434. Of course that does not show that it contains water, because ordinary alcohol is miscible with water ?—It is very easy to get it into it when it is miscible. You could not get water into it otherwise.

3435. The fact that it mixes with water is no proof that it already contains water. You buy what I presume you call strong alcohol, do you not ? What do you buy, 95 or 97 per cent. alcohol ?—Yes.

3436. And at the same time you buy, if you do buy wood naphtha, strong wood naphtha which contains at most not more than 10 per cent. of water ?—I am sorry that I do not know enough of the methylators' system of working to throw any light on that.

3437. Do you buy wood naphtha alone—separately ?—Yes, sometimes.

3438. What steps do you take to authenticate it and to see that you get a proper specimen ; do you buy it by the gravity, or how do you buy it ?—We buy it by the sample, as a rule. I think they test it for gravity, but I am not sure.

3439. How do you know that you do not get it mixed with water ?—We do not use that in making these varnishes ; it is for special purposes of our own. I hope you do not think that the fault may lie with us in mixing the wood naphtha. That contains water already.

3440. I really was addressing myself to what is apparently a difficulty in your mind. You seem to think that because the wood naphtha is miscible with water,

Mr. J. J. Gittings.

20 Dec. 1904.

therefore it contains water?—No, but it might do very often, and then it would be very difficult to detect it.

3441. It would not be any more difficult than to detect the presence of water in ordinary alcohol, namely, by the use of a hydrometer. You buy your alcohol by strength, do you not?—Yes.

3442. The hydrometer indicates to you whether it is or is not mixed with water?—Yes.

3443. If you turn to the proper table you can tell from the hydrometer strength what is the strength of the alcohol, in other words, what is the amount of water in it, can you not?—Yes.

3444. You can do exactly the same thing with wood naphtha; if you place a hydrometer in it, it gives you the specific gravity, then on turning to the table you can determine the amount of water which may be there?—As far as we use wood naphtha it does not matter much whether it does contain water or not. I was only speaking there of the wood naphtha that they use in methylating the spirit.

3445. Precisely, but the methylater can do, and does as a matter of fact, the same thing, and he eventually gets an alcohol which is of a certain strength, sixty-three, sixty-four or sixty-five over proof, whatever you like to covenant with him to sell you. It may be that you, by inadvertence or even by design on your part, get a methylated spirit which contains a certain amount of water?—I can assure you we do not know of it, if we do.

3446. What do you stipulate—that the strength of your methylated spirit shall be so much?—That it shall be sixty-four over proof.

3447. And you have no doubt you get it?—Yes, we get it.

3448. You get therefore the amount of water which is associated with alcohol sixty-four over proof—whatever that amount may be?—Yes.

Lacquer made in Spain. (*See ante* Q. 3395.)

3449. And you get no more—do you follow me?—I follow you, but it does not get me out of this difficulty—that whereas we could not make it in England free from these defects, we can make it in Spain free from the defects.

3450. And yet in Spain you have no knowledge of the strength of your alcohol?—No, because I do not think they have any knowledge themselves.

3451. If you went over to Spain with the same hydrometer that you use in England, you would get your information at once?—Yes, I daresay we should; but it is a very difficult thing to take scientific instruments to Spain. I have several times taken thermometers and things of that sort and they have always been broken in transit. Even if I have carried them in my own bag, they have broken them at the *douane*.

3452. It strikes me that a Sykes' hydrometer is not a thing that is very easy to break?—That may be, but the consequence is that we are very chary about taking any instruments there. Of course it is more rule of thumb there than it is here.

3453. (*Mr. Tyrer.*) As you have had samples of varnish from your friend in Spain, it would be interesting if you could ask him to send you some of the spirit which they use there and then get Mr. Hills to take the specific gravity?—I will do that.

Shellac as a denaturant. Its inadequacy to afford any protection to the Revenue.

3454. (*Dr. Thorpe.*) Your suggestion to the Committee is that you should be allowed to use in denaturing, a certain small quantity of shellac?—Yes; that would suit us.

3455. That is to say, you should denature your alcohol, not by the addition of wood alcohol, which earmarks it, but by the addition of shellac. Now what do you think would happen, or might happen, if spirit varnish containing that additional quantity of shellac which you require to make it a mercantile article, got out? In the first place you sell it?—Yes.

3456. That is, you sell an article containing pure spirit with perhaps as much as 10 per cent., or not more than 10 per cent., of shellac and certain other things, in it?—Yes.

3457. Would it not be very easy to get that spirit out?—No, I do not think it would be very easy to separate it from the shellac again.

3458. Supposing it were distilled?—They could distil it, of course.

3459. What would be the character of the spirit that would be so distilled?—It would come off free from the shellac, I should think.

3460. It would be a perfectly pure spirit then?—Yes, it would.

3461. Under such a system as that, what guarantee is there that the Revenue would be in any way protected? Here you sell wholesale, or might sell wholesale, an article of that kind which might be subjected to distillation, and then the spirit, which would be a pure spirit, might be recovered?—I quite see your point.

3462. The price of such a varnish would depend very largely upon the amount of shellac in it, would it not?—Yes.

3463. Supposing anybody were engaged in this kind of business, he might covenant with you to get a shellac varnish at as low a price as 3s. 6d. per gallon?—Yes.

3464. It would be perfectly easy to distil that so-called shellac varnish, and get the alcohol off; and that, without any detriment to the shellac, might be used as varnish. That is to say, he might actually take off three-quarters of a gallon, costing 3s.6d., and then he would get a pure spirit which would be worth 14s., with the duty?—Yes, I see; but of course you are asking me things that have to do with the general public. I can answer you only as far as our own works are concerned.

3465. We have got to look a little beyond your works?—I quite see that.

3466. We have got to look at the possibility of somebody purchasing a few gallons of this stuff, ten gallons or twenty gallons it might be, then subjecting it to distillation, and so getting off what in the market would be worth 14s., although they had only paid you 3s. 6d. for it. Do you think that is a condition of things that we can authorise?—That is a situation which I cannot throw any light on. It is more for you gentlemen connected with the Inland Revenue. I am only concerned in it as far as it relates to my own trade as a spirit varnish manufacturer.

3467. The case which I have just suggested to you is not a hypothetical case at all. Such a fraud as I indicated to you might take place—has taken place on more than one occasion. You never heard of that?—No.

3468. You never heard of a trader, for example, who carried this operation on—not in the case of pure alcohol, but in the case of methylated spirit—to such an extent that he was detected and fined £1,200?—No.

3469. He bought finish, distilled it and used that for the purposes of his trade illicitly?—I do not know why he should buy finish, because that has got rosin in it.

3470. He was a person who used spirit. He could not honestly come by methylated spirit, but he could buy finish in the open market—any oil and colour man would supply him with finish; he distilled that finish, recovered the methylated spirit, and used that methylated spirit free from any mineral naphtha or any thing of that kind. He could not otherwise have got the methylated spirit, except through the usual official channels, and he did not want to go through the usual official channels?—But he could not drink the methylated spirit.

3471. He used it for the manufacture of articles in which pure spirit was contained, then exported those articles, and claimed rebate from the Custom House on exportation?—I do not see how it would help him at all—I do not really. There are two ounces of rosin to the gallon of finish I think, or something like that.

3472. I will leave you to ponder over that. This is the point, however—that man was detected and convicted, simply because of the earmarking substance—the methyl alcohol or wood naphtha—which it contained. Assuming that same individual had tried the same thing with your varnish, we should not have caught him: the thing would not have been earmarked, and we could not have got the same kind of evidence to convict him that we got in that case?—I see your point.

Suggested drawback on exported lacquers. (*See ante* Q. 3407–9.)

3473. (*Mr. Scott-Montagu.*) I suppose if you were allowed a drawback on the spirit in the varnish you sent abroad, that would satisfy you to a great extent?—Yes, if we had an Excise duty.

3474. If they gave you a drawback only on your export varnishes or lacquers—which I take it would not interfere

with any Revenue precautions, and would not in any way hurt the Revenue here—that would satisfy you?—That would satisfy me entirely, because if I get the article cheaper in this country—supposing, for instance, that I could get the pure spirit for 9d. or 10d. a gallon here—I should have to reduce my price accordingly. Therefore I do not care, so long as I can get the rebate when it goes to foreign countries; then it puts me on a level with my foreign competitors who fight against me in the neutral markets. Now I have not a chance, but I should have a chance then.

3475. Still, as you have told me, you would be satisfied if you could get the duty back on exportation?—If we could get the duty back on exportation that would suit us. What it would mean would be that we should buy a certain quantity of these pure spirits of wine, and pay 12s. or 14s. per gallon for it, as the case might be, and get the rebate when it went out of the country. Naturally we should not use it in the country itself, as it would not pay us, because nobody would pay us the price that it would mean.

3476. It would not be to your interest to use it, except for the lacquers and varnishes that you exported?—That would be so.

3477. (*Dr. Thorpe.*) That was not originally your position. Your original position was that you wanted the pure spirit and you thought it would be suitably denatured by the use of a quarter of 1 per cent. of shellac?—Yes.

3478. (*Mr. Scott-Montagu.*) But you would be satisfied if you received a drawback on your exported goods?—Yes.

3479. (*Mr. Tyrer.*) I think, if I may say so, you have been educated in the course of the last half hour up to this point—that you will pay the duty, at which no one grumbles, and when certain things are done which are legitimate, and would be done in the open daylight, the duty may or may not be fully or in any part refunded?—Of course I am only looking at it from my point of view. The point of view that I started with is the point of view of a varnish manufacturer, not the point of view of a taxpayer of the country or anything of that sort.

3480. (*Chairman.*) Do you represent a body of opinion in your trade, or do you represent only your own firm?—Only our own firm.

3481. Then you have not had any communication with any other firm?—We have not had specific communications with other firms. Of course we have occasionally talked over matters when we have met, but I mean I am not the representative of others.

3482. Is it your opinion that the trade as a whole would endorse your views on the subject?—Yes, I am sure they would.

3483. Are you aware that there are people in the trade, even in Birmingham, who would not?—They are not varnish manufacturers, I think.

Opposition to granting facilities for use of pure spirit duty-free in making lacquer.

3484. We have had evidence from a very large firm of lacquer and varnish manufacturers in Birmingham who are opposed to any change. I would like to read one or two answers to you:—"(Q. 2235.) Do your goods obtain a market on the Continent?—(A.) We have a very big customer in Germany, and we have customers in France. Of course, we are in competition with French and German makers." "(Q. 2237.) Do you cut your prices down in order to get into the German market?—(A.) No." "(Q. 2245) You can command the same price there"—in Germany—"as here?—(A.) I can get a better price there." "(Q. 2247.) Do you do a large business in France?—(A.) Yes, we supply a lot of stuff to the bedstead trade there." So there is a firm in your own town which is perfectly satisfied with the present state of things, but whose experience is not the same as yours as regards being cut out of the Continental market?—May I ask are they methylators?

3485. They are methylators?—That answers the question, if you will allow me to say so.

3486. Why?—If they are methylators, they know perfectly well that if this pure spirit came in, their methylating trade would be done.

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3487. They are only methylators for their own purposes?—Are they Lambleys?

Mr. J. J. Gittings.
20 Dec. 1904.

3488. It was a representative of Messrs. Lambley?—Lambleys applied for permission to use pure spirit duty free in August 1903, and gave, as their chief reason for asking for this permission, their opinion that a pure spirit lacquer was superior in every way. That you will find by your own applications here, I believe. They were refused, and consequently put down methylating plant.

3489. They are only methylators for their own purposes, they are not methylators for sale?—They will sell it as well.

3490. I daresay they would?—They put down a plant for methylating, and they do not want to see their plant scrapped.

3491. (*Dr. Thorpe.*) I asked that question specifically, whether they methylated for sale, and the answer was no, it was done solely for their own consumption?—All I can say about that is, that if you examine every other varnish or lacquer manufacturer in the kingdom who is not a methylator, you will find that their ideas agree with mine.

3492. (*Mr. Tyrer.*) There may be a little confusion; are you confusing the sale of methylated spirit with the sale of varnish or lacquer made with methylated spirit—which do you mean?—I mean that naturally they do not want their methylating plant scrapped. They have put money into methylating.

3493. (*Chairman.*) The methylating plant is a very insignificant plant, and it would cost very little to put it down?—If they now want to keep it on, why did they want in 1903 to use pure spirit, and why did they then give as the reason that it made a better lacquer in every way.

3494. I do not know that they did, but I will have the papers looked up. Take another firm: This question was asked of Messrs. Lambley's representative—"(Q.2210) Do you know whether that view of the firm of Messrs. Lambley is shared by other members of the trade?—(A.) Yes, by one of the largest; that is Llewellyn Rylands, Limited"—they are also a Birmingham firm?—I know Rylands. There are special reasons rather why Rylands would probably chum in with Lambley's.

3495. (*Dr. Thorpe.*) Do the firm of Rylands themselves methylate?—No, Rylands do not methylate.

3496. Therefore whatever advantage Messrs. Lambley have got by methylating, that does not attach to the other firm which concurs in their opinion?—No, but there are other points which it would not do for me to mention.

3497. You give as the reason why Lambley's were in this position, because they methylated?—Yes.

3498. This other firm, which is an equally large firm, I understand, does not methylate?—They are not as large in the lacquer manufacturing as Lambley's.

3499. Are they as large spirit users?—Probably they are, because they make varnishes as well.

The view maintained that English lacquers are losing ground in neutral markets.

3500. (*Chairman.*) Could you explain how it is that Lambleys retain their Continental trade, and can get even a better price in Germany than they can in England?—I very much doubt it. I go all over the Continent myself. I have been pretty well all over Europe for trade, and I know perfectly well, if they are doing a trade in Germany now, they will not do it for long. The Germans have a very nasty knack of giving your samples out to their compatriots, and so soon put you out of the market.

3501. Still, there it is; up to now, they are not in the position that you say you and other people are in, of having lost their Continental market?—I know Lambley's have lost a lot of their trade in France. In Paris they have lost a lot of trade.

3502. They say they have got a very good trade?—They have lost a lot. I will answer for that; I know several places in Paris they were dealing with, that they are not dealing with now

3503. That may be because of the duty?—Of course I am only going on the broad result.

3504. This is evidence that the Committee cannot altogether disregard, from the point of view of the disadvantages of methylated spirit. Here we have people whose experience quite differs from yours, and who tell us that they find no disadvantage, and that, although they use methylated spirit, they can compete as regards price and as regards quality both in Germany and in France.

Mr. J. J. Gittings.
20 Dec. 1904.

That rather suggests that we have not nearly got to the bottom of the subject of methylated spirit from your point of view, and that there may be other reasons, unconnected with the methylated spirit, which have led to your losing the Continental market ?—Their evidence would be very much more valuable if they were not methylators, if you will allow me to say so.

3505. (*Dr. Thorpe.*) One of them is not, as you have already admitted ?—I think if Mr. Rylands were up here he would admit that it would be very much better for the trade to have pure spirit ; he would say so straight out. Of course I know that the two firms of Lambley's and Rylands do go together a bit.

3506. (*Chairman.*) There may be other reasons ; for instance, they may not take the same view as you do of the advantage, or rather the absence of advantage, of having the home market fully protected ?—I am absolutely certain that Lambley's and every other varnish and lacquer maker in England has lost trade on the Continent ; and I am absolutely certain that, collectively, we are not doing anything like the trade that we did twenty years ago.

3507. That may be due to quite other causes, may it not ?—Quite so. Was this specific question put to Messrs. Lambley's representative—Are you doing as much now as you did ten years ago ?

3508. No, because we could not expect that. I think we have heard a great deal lately as to the fact that duties on the Continent on English goods have been put up very much in the last twenty years. That must have some effect, and must keep a good deal out of France and a good deal out of Germany, and so on. Therefore to have asked that question would not have helped matters. But you see these people are quite content with the business they are doing ?—I am thinking of neutral markets. For instance, take English and Germans competing in France ; the duty is the same against German varnish and lacquer as it is against English varnish and lacquer, but the Germans have certainly encroached upon our trade.

3509. Even in France ?—In France, and in all neutral markets. I am only mentioning France as an instance. And so do the Americans encroach upon our trade.

3510. Do you know as a fact that the German trade in lacquer and varnish in France has increased, while ours has diminished ?—Yes, I know that to be a fact.

3511. From statistics ?—Not from statistics, but by going round myself.

3512. But you cannot tell from that. Statistics of trade might enable you to do it, if they specified these things ; but surely you have not exhausted the subject in France personally ?—No, I have not been to every little manufacturer. Take, for instance, the bedstead trade. We know every big manufacturer of bedsteads in Paris. Ten years ago, when I used to go over, we found English varnish and English lacquers used exclusively. Now, when I go over I do not find them used exclusively. I find that the Germans have knocked us out in lacquers, and that the Americans have knocked us out in varnish. Therefore I say, if there is any firm which is in the extraordinary position of not having lost trade, it is absolutely an exception.

American varnishes.

3513. (*Dr. Thorpe.*) With respect to American varnishes, are they spirit varnishes ?—A great many of them ; but they use other ingredients that we have not been accustomed to use in England.

3514. In that is their virtue, possibly ?—Of course to some extent ; but, on the other hand they are things that there has been a dislike to in England. For instance, the Americans make a great deal of use of acetate of amyl in making varnishes.

3515. So I believe they do in England, to some extent ? —To some extent, but to nothing like the extent that they do in America. Then they use fusel oil ; of course we use fusel oil ourselves.

3516. Do you know whether there is any rebate on the spirit varnish or lacquer exported from America—if there be any lacquer exported from America ?—I do not know ; I am sorry that I cannot answer that question.

Fusel oil as a substitute for wood naphtha. Objections on ground of price and smell. (*See also* Qs. 3538–45.)

3517. Supposing that you were asked to adopt some other method of methylating than adding methyl alcohol, would you use fusel oil in place of wood naphtha ?—The objection to fusel oil is that it has such a strong smell, and it is so high in price now. It is very dear.

3518. Apart from the price and the smell, is there any objection to it ?—No.

3519. It could be used to mix with the pure spirit ?—Yes, it could be mixed with pure spirit. There is no objection to it from the manufacturer's point of view, because it is a very good solvent.

3520. Are you speaking of varnishes or of lacquers ?—I am speaking of both. A lacquer is only a thin varnish really—perhaps made with a few different ingredients.

3521. I understand there are hot lacquers and cold lacquers ?—Yes.

3522. For a cold lacquer I understand you can use fusel oil ?—You must ; you cannot use methylated spirit exclusively with that.

3523. For a hot lacquer can you use also fusel oil ?—Yes, you can use it ; but if you were to use it in any large quantities it would make the people sick who brush it.

3524. Is that the only reason against it, as far as you know ?—Yes, that is the only reason.

3525. There is no objection otherwise ?—No, except price.

3526. I am only speaking of its nature, apart from its price ?—I understand. It is a very good solvent indeed.

Lacquer as a raw material. Drawback (*See ante* Qs. 3473–9) would make it cheaper to foreign manufacturers than to English.

3527. (*Sir William Holland.*) I understand you to say that it would help you a great deal if you had a rebate on export ?—Yes.

3528. What you sell, of course, is somebody's raw material ?—No, it is not a raw material, it is a manufactured article. What we sell are varnishes of all kinds, coloured for toys and bicycles and so on.

3529. What class of individual buys those varnishes ? —All manner of manufacturers.

3530. Therefore what you sell is to them their raw material ?—I thought a raw material was something that there had been no labour in manufacturing put on.

3531. What is the product of one manufacture is frequently the raw material of another manufacture, and surely must be so, if it is not finished for consumption by the public ? Is what you sell retailed in shops to the general public ?—Yes. Take for instance bicycle black. A large firm in Birmingham put up hundreds of gallons that they buy from us into little tins, and naturally retail it to the public.

3532. In so far as that section of the demand goes, of course it is a manufactured article ; but in so far as it is bought by other manufacturers, I presume it may be regarded as their raw material. If a rebate were allowed on export, would it not follow that the foreign manufacturer in getting his raw material, if your product be his raw material, would be getting that raw material cheaper than the British manufacturer would get it from you ?—If you call that a raw material, yes, that would happen.

Chief importance of alcohol question, so far as concerns lacquers, lies in export business.

3533. (*Mr. Nicholson.*) I understand you are quite contented with the state of the Home market, and that you want no alteration in that ?—Of course, as I say, it would be better to use pure spirit from our point of view. I can quite see the difficulties of the Revenue authorities. As far as we are concerned, if we got the spirit cheaper we should have to reduce the price to our customers, so it is as broad as it is long to us in regard to the home market.

3534. Therefore you are contented with the state of things at home ?—Practically, except that we do not get quite so good a result.

3535. Then it is your export business that you are principally concerned with here ?—Yes.

3536. Have you ever tried making varnish with a duty-paid spirit, and then presenting it to the Custom House and asking for a rebate on the duty ?—No, we have never tried that.

3537. Then you are not prepared to say that you cannot do that ?—I did not know that it was possible. I always understood that we could not get a rebate, as rebates were not allowed in this country as a general thing.

Fusel oil as a denaturant (*See ante* Qs. 3517-26.)

3538. (*Mr. Tyrer.*) Have you any notion what amount of fusel oil would be sufficient to denature spirit, if you were allowed to use fusel oil in place of wood naphtha ?—I have not any idea. But fusel oil now is very scarce; I do not know why, but I think they have found out another method of using it.

3539. What price are you paying to-day ?—£68 per ton.

3540. Which works out, per gallon, to what ?—About 6s. 2d. per gallon.

3541. (*Dr. Thorpe.*) Then that would be no relief to you, obviously ?—No, it would not.

3542. (*Mr. Tyrer.*) Except that a smaller quantity might be used ?—Yes.

3543. (*Dr. Thorpe.*) Two shillings and ninepence is the price of good naphtha, is it not ?—I take that from you.

Mr. J. J. Gittings.

20 Dec. 1904.

3544. (*Mr. Tyrer.*) What do you pay for methylated spirit ?—One shilling and eightpence halfpenny, or 1s. 9d., according to the amount we want at the time.

3545. (*Mr. Nicholson.*) Do you know what is the other use that you think has been found for fusel oil ?—I think it was something in the explosives line, but I am not quite sure. It has gone up wonderfully in price. I can remember the time when it was almost given away, and we could buy it at 1s. 6d. per gallon; but to-day we cannot buy it under about £68 per ton.

Mr. ALLAN THOMAS COCKING, called; and Examined.

Mr. A. T. Cocking.

20 Dec. 1904.

3546. (*Chairman.*) I think you are the Resident Director of Kynoch, Limited ?—I am.

3547. They are ammunition makers of Lion Works, Birmingham, and also of Kynochtown, in Essex, of Arklow, Dublin, and other places ?—Yes.

3548. You are a chemist and an engineer, I believe, and have had a great experience in chemical industries requiring the use of spirits ?—Yes.

Lacquers. Disadvantages of methylated spirit.

3549. In your *précis* the first thing you deal with is lacquer work; have you yourself got to do with the manufacture of lacquer in any way ?—Yes, we make finished brass-work ourselves.

3550. I understand you are convinced that methylated spirit does produce a dull effect ?—Yes, I think there is no question about that.

3551. Of course there is no question that it is expensive ?—That is so.

3552. Do you consider that your work is inferior to the German work ?—In the polish, the finish, certainly.

3553. You are aware, I suppose what they do use in Germany; you do not suppose that they use absolutely pure spirit ?—Practically they do. I believe they use spirit for that purpose containing shellac.

3554. That is not the case; however we will not go into that. Have you been under the impression that in Germany they use nothing but shellac ?—Or a nominal amount of bone oil, we are told, We have made inquiries and we are told that that is so, and that we can make lacquer there by complying with certain conditions.

3555. The evidence is all the other way, but we need not go into that perhaps. To what would you attribute the disadvantage of using methylated spirit in lacquer making ?—There is no doubt that shellac dissolved in naphtha alone does produce a lacquer which gives a bad polish. I attribute it to the wood spirit.

3556. You have not made any investigations of your own in order to determine what it is in the wood spirit that is injurious ?—No, I have not.

Smokeless powders. Mixture of methylated spirit and methylated ether as a solvent.

3557. As regards the smokeless powders, at present I see you are using acetone as a solvent ?—Yes, chiefly.

3558. Do you use any alcohol ?—Yes, large quantities.

3559. Do you use that as a solvent ?—Yes.

3560. In what form ?—Methylated spirit mixed with ether.

3561. Is the ether that you use methylated ether ?—Yes.

3562. Do you find any disadvantages from using methylated spirit and methylated ether ?—We find very great disadvantages.

Its disadvantages. (*See also* Qs. 3593-600, 3721-35.)

3563. In what way ?—It is so difficult to dry. Wood naphthas are not so volatile at the temperature at which we are allowed to dry our powders. That is one great objection. The objection to the cost in our case is multiplied very much, because of the non-solvent properties of the wood naphtha; not only do we pay more for the methylated spirits, but we lose 10 per cent. of the weight; there is also the extra cost of producing the ether, and there is a 10 per cent. loss again there.

3564. Where you use spirit as a solvent you recover the greater part of it, do you not ?—Very little.

3565. In some operations you recover a great deal, do you not ?—We can do so, but, as a matter of fact, we do not. We intend to do so. We recover none of the acetone.

3566. What is the price of acetone at the present time ?—Acetone cannot be bought at the present time; there is none. Our contract price is £44 10s. 0d., but we are gladly paying £80 for little bits that we can buy. Our factory is standing at the present time, because we cannot get acetone.

Present scarcity of acetone. (*See also* Qs. 3575, 3613-5, 3624-32.)

3567. What is that due to ?—It is principally due to the extra demand caused by the Eastern war. The strongest point that I wish to make is the national danger, owing to our dependence upon acetone as the solvent for guncotton. At the present time no other solvent is used for guncotton; there is none produced in England. We cannot produce acetone in England. The supply is strictly limited to America and a small quantity on the Continent. Not only is it impossible to meet any extra demand, but there is always the danger arising from having to carry it such a long distance. We have a great loss in transit, and any delay in the shipments means a very serious delay ultimately.

3568. You have not approached the Board of Inland Revenue with a view to being allowed to use pure spirit, have you ?—Not directly.

Finance Act, 1902, s. 8. Its provisions not known and not tried.

3569. Have you considered that matter ?—Yes. In the case I refer to in my *precis*, where we suggested the use of spirit to render safe the operation of mixing guncotton with nitro-glycerine, that was really forbidden by the War Office, because of the uncertain effects of the methylated spirits. We were told that we might renew our application, if we could induce the Board of Inland Revenue to allow the use of pure alcohol.

3570. But you did not make any attempt to induce the Board to do so ?—No, we knew it could not be done.

3571. About what date was that ?—That was twelve months ago last June.

3572. You might have made an application to us under the Act of 1902, might you not ? Were you aware of the existence of that Act ?—No, I was not.

3573. Since 1902 the Board of Inland Revenue have power to allow the use of pure spirit, though as a rule they require that it should be denatured in the works before it is used, if that is possible, in some way which will not be injurious ?- With us that could very easily be done; we could add nitro-glycerine to it.

3574. If you had known of the Act, would you have been disposed to come to us ?—Yes.

3575. At the present moment when you are in this difficulty as regards the acetone, I suppose it becomes even more important ?—It has become a very serious thing. At the present time, if for any purpose the War Office were to require an increase in the amount of cordite produced in the factories, it could not be done, because the acetone could not be obtained. We could not now produce in England any appreciable increase of cordite, because of the scarcity of acetone. Whatever other point is considered, I do think that this, from the national point of view, should be considered—that either acetone should be produced from alcohol, or a substance such as amyl acetate should be produced from potatoes as a substitute for the acetone.

Fulminate of mercury. Use of spirit denatured with bone oil and crude ethers.

3576. Then you refer to the manufacture of fulminate of mercury, and you say that denaturing there by means of

Mr. A. T. Cocking.

20 Dec. 1904.

an addition of bone oil and eleven gallons of the recovered crude ether to each 100 gallons of pure alcohol, is objectionable. Are you speaking from experience there?—Yes; we cannot get the proper crystallisation required for high-class work.

3577. Where has your experience been in connection with that?—In connection with Helcké Brothers. Formerly they manufactured in the Channel Islands. Owing to an explosion they have been compelled to leave there, and they are therefore making it for us at Faversham in Kent. They find the greatest difficulty in meeting our requirements; in fact, they cannot give us what we want. I have investigated it with them. The difference is due to the presence of the bone oil apparently; at any rate they can get it without the bone oil, or they can get it with the bone oil if they were allowed to use only about half the present quantity of the recovered ether.

3578. (*Dr. Thorpe.*) Have you any idea how much bone oil there is?—I do not know that. It produces a greasy effect.

Proportion of bone oil too small to produce harmful effect.

3579. It is 0·025 per cent.?—It cannot, of course, be the bone oil, if that is so.

3580. (*Chairman.*) Your evidence on that point is what I might call second-hand?—Yes, to some extent. There is no doubt that we are not getting the same quality of fulminate of mercury that we were getting when it was manufactured in the Channel Islands, and the bone oil is the only difference that I know of.

3581. (*Mr. Tyrer.*) At what stage in the preparation of fulminate of mercury do you use the spirit?—It is added to the nitric acid solution of mercury.

3582. Do you really think that that small percentage of bone oil would affect it?—I do not think so, now I know that it is so small. I would like to withdraw the statement that it is due to the bone oil, and I now say that it must be due to the excessive amount of the crude ether.

3583. (*Sir William Crookes.*) You are satisfied that something or other interferes with the purity?—Upon that there can be no doubt.

3584. Whether it is the bone oil or anything else, there is something in it that does interfere with the purity?—That is so. We do not know what is the composition of those crude ethers when they are once distilled. It is the ten or eleven parts of that, no doubt, which produces the effect upon the crystallisation.

Cordite manufacture stopped through lack of acetone.

3585. Do you manufacture cordite?—Yes.

3586. Do you supply the Government with it?—Yes, largely.

3587. Of course, it has to go through certain tests?—It has.

3588. How does your manufacture stand the heat test?—Very well; we do not use any alcohol in cordite, only acetone.

3589. Then since you are unable to get acetone, you have not been able to supply any?—No, we are stopped absolutely; our factory has been stopped for the past month—the first time during the past eight years.

Mixture of alcohol and ether a satisfactory substitute for acetone.

3590. Supposing you were allowed to use pure alcohol and ether, could you make cordite with it?—Yes.

3591. Would it be of the same kind of consistency and physical appearance made with alcohol and ether as it is made with acetone?—There would be no difference in the effect. I think we should have to make amyl acetate before we could get a proper solution of the guncotton; but whatever solution were adopted, providing it is an absolute solvent for guncotton, there would be no different ultimate effect upon the explosive. All that is required is to get the guncotton into solution. There is practically none of the solvent remaining in the cordite.

3592. Do you think it would stand the heat test better?—Yes, I am certain it would. Of course, we use alcohol for other explosives, and we have no difficulty with the heat test there.

Nitro-cellulose powders. Use of methylated spirit.

3593. Do you make a pure nitro-cellulose explosive?—Yes.

3594. Do you make that with pure alcohol?—No, we make it with methylated spirit.

3595. Does that stand the heat test well?—Yes, it does stand the heat test, but the Government requirement for that is only ten to fifteen minutes at 160 degs., whereas for cordite it is thirty minutes at 180 degs., so that we have a much more severe test for cordite. Its effect on the heat test.

3596. The Government are not buying nitro-cellulose, are they?—No, not nitro-cellulose, but there is a Government test for that.

3597. Have you any views as to whether the use of methylated spirit would lower the heat test?—I cannot say definitely that it would, but the uncertain composition of methylated spirit causes different effects to be had at different times. We certainly have had lower heat tests, but we have not been able to repeat that on every occasion. The real difficulty is that you cannot drive out the whole of those naphthas, and what may be the ultimate effect of their presence in the nitro-cellulose has not been determined; but it was sufficient to enable the War Office to say that they would not allow it.

3598. Do you know whether it would have any effect on the keeping properties?—I should say it is very likely to do so, because you must have the greatest purity. Nitro-cellulose must be absolutely pure in order to stand prolonged keeping; and you do not know what you introduce in those naphthas. and keeping qualities of the powder.

3599. (*Dr. Thorpe.*) Do you know that wood naphtha actually does introduce impurities?—No, I do not.

3600. It is a surmise, then?—It is a surmise which tells very much against us, because we are not allowed to use it.

3601. (*Mr. Scott-Montagu.*) We were told the other day by a witness who makes a good deal of powder for the Government—namely, Captain Tulloch, of the Chilworth Company—that he had had a certain contract offered to him for nitro-cellulose powder, but that the expense of the ethers and alcohols was such that he could not supply the Government at anything like a price that they thought was a fair one?—That is so.

3602. Yet I understand you to say that you do supply a nitro-cellulose powder, and, I presume, at a profit to yourselves and at a price satisfactory to the Government?—We supply only ourselves. We are large ammunition makers. As a matter of fact, we buy much more than we make, and it is a fact that we can buy it really cheaper than we can produce it. Such powders almost all made in, and procured from, Germany

3603. Do you buy it from Germany?—We do. I might say that pure nitro-cellulose powders are made almost entirely in Germany. The only explanation is that they have the use of pure spirit.

3604. Do you agree with Captain Tulloch that the future of military powders is in the direction of a nitro-cellulose powder?—I do, certainly. Future of nitro-cellulose powders

3605. Therefore it is important that we should be able to make nitro-cellulose powders in this country?—It is most important. (*See* Q. 2381.)

3606. Both from a commercial and from a national point of view?—Absolutely so.

3607. When you said that you were interested in lacquer work, did you mean the lacquer on brass cartridge cases?—Not only on brass cartridge cases, but we do a finished brass trade.

3608. Besides the cartridge cases?—Yes. We make all kinds of Birmingham brass stampings and castings.

3609. I suppose that upon the lower classes of those things—for instance, cartridge cases and brasses of that kind—it is not so important to have a first-class lacquer?—The only importance is in the cost. So long as the Government are content to take the cases with the finish that methylated spirits produce, it makes no difference to us, except that we pay more for our work than we should otherwise.

3610. Do you agree with other witnesses who have come forward on behalf of the sporting gunpowder trade in thinking that a great element of danger would be avoided if you could use alcohol, because then you would not have to use the drying process at such a great heat?—I think that is most important, and I attach the greatest importance to it. I consider that if we were allowed the use of pure alcohol for the purpose of drying guncotton, Sporting powders. Advantage of alcohol in avoiding the dangerous drying process.

the number of fatal accidents would be reduced by one-half at least. I consider that if that were allowed it would introduce so much safety into the manufacture of explosives that we might do without the Home Office inspectors. I think that their supervision and their regulations cannot produce anything like the safety which would be given to the trade if alcohol could be used as a method of drying guncotton. It is the only really dangerous operation in the manufacture of explosives. I should say that two out of every three or four lives lost in the manufacture of explosives are lost in the process of drying guncotton; not only that, but you cannot dry it in a satisfactory manner by heat; you have got at least 2 per cent. of water remaining in it afterwards. It is a very dangerous process, and a process which is almost certain at some time or other to result in an accident, because you cannot take sufficient precautions to prevent small quantities of guncotton dust getting between the boards of the buildings and on to the heating surface, and then it is only a question of how long it will be before that decomposes, for it must decompose at some time unless it is removed.

3611. So that you would regard the use of alcohol in the explosive trade from two important points of view: first, from the point of view of eliminating danger at present?—Yes.

3612. Then also you would regard it from the solvent point of view?—Yes.

Importance of alcohol question emphasized by scarcity of acetone.

3613. If you do not have some solvent other than the solvent you have got at present, we might be in such a state in this country that we should be unable to manufacture powders?—Yes. I think that is the state now; we could not produce these powders to-morrow.

3614. It sounds astonishing, but is it absolutely a fact that at the present moment you could not put your works in operation to-morrow morning because of the want of one single thing, namely, acetone?—It is an absolute fact. We are being fined at the present time by the British Government for delay in one special contract, and we cannot do it because we cannot get the acetone. That is a danger which is not realised sufficiently, and it is a danger which some day may be very acute.

3615. Has it ever occurred to you that you might ask the Board of Inland Revenue for permission to set up an apparatus for producing acetone in this country?—We have produced acetone ourselves and abandoned it because of the cost. We spent thousands of pounds in endeavouring to produce acetone.

Production of acetone from alcohol commercially impossible without cheaper alcohol. (*See* also Q. 3650–3, 3790).

3616. In the manufacture of acetone is so much alcohol used that you practically cannot do it?—I think that alcohol is the only alternative. At the present time alcohol is not used for this purpose. Acetone is made now by the destructive distillation of wood. The pyroligneous acids are neutralised with lime, the calcium acetate is distilled in a dry retort, and the acetone recovered by that method is purified. The alternative method would be to oxidise alcohol and produce acetic acid and then follow the same operation; but it would mean more than a special permission to one person to do that—it would mean first producing an industry and making alcohol more cheaply than it can be bought at the present time without regard to the duty. Alcohol would have to be produced in England as cheaply as it is produced in Germany before that could ever be a commercial success.

3617. So you have not really contemplated the possibility of setting up this manufacture?—No, not for its manufacture from alcohol.

3618. You have ascertained from definite experiments that methylated spirits are not an adequate substitute?—Methylated spirit will not do; it would be absolutely fatal.

3619. You have not tried any relief under the Act of 1902?—No. I do not see that anything could be done in England short of the general production of potato spirits.

3620. (*Mr. Nicholson.*) What makes you say potato spirit?—Because it is much cheaper than a grain spirit.

† *See post* Q. 3661, etc.

3621. Really?—I was under that impression. I do not say it as a fact, but I thought so.

3622. (*Chairman.*) Potatoes have an awkward knack of failing altogether sometimes?—Yes; but fusel oil, I think, is usually obtained from potato spirit.

3623. (*Mr. Nicholson.*) And from grain spirit also, is it not?—Yes.

3624. (*Sir William Crookes.*) Do you know what they are doing at Waltham Abbey about acetone?—They are recovering a certain proportion.

Scarcity of acetone. Reasons for high price.

3625. Do they get it all from Germany?—No, they get it principally from America. They abandoned the manufacture of it before we did.

3626. I believe they have a very large plant at Woolwich for making acetone, and they have ceased to make it?—Yes. We ourselves found that we were buying it at from £40 to £50 and it cost us £120 per ton to make.

3627. (*Mr. Tyrer.*) Have you any idea what is the reason for that?—Because we had to get the acetate of lime from America where it is produced, and you require about five tons of acetate of lime to make one ton of acetone. The cost of the carriage and the handling of such an enormous quantity makes it impossible to compete with just the carriage on the finished article. We have to buy the acetate of lime in America, as it cannot be produced in England commercially.

3628. It is not cheap enough here, you mean?—It is not sufficiently cheap here.

3629. Surely that does not account for the difference between say the present price, or what may be taken as the average for this year, which is somewhere about £65, and about double that price?—The price to-day is entirely due to the increased demand, and the fact that there is no means of meeting that demand. So long as acetone is made only from the destructive distillation of wood, the amount of acetone available is of course limited to the amount of material recovered by the distillation of wood. This difficulty has occurred before; on every occasion when there is a demand for explosives, the price of acetone rises quite out of proportion to the cost.

3630. Quite out of proportion to your cost, you mean?—I mean quite out of proportion to the cost of production. Of course the real demand is the demand for explosives.

3631. The average price of the acetate of lime has been something between £7 and £8 15s. I think?—That was the average price, but I suppose you would pay almost double that now.

3632. Now it is £11 10s.?—I do not know the present price; I am judging from the price of acetone.

3633. (*Sir W. H. Holland.*) In reference to the increased safety which you say would arise from the use of pure alcohol, of course that is a very important matter, and I do not wish for a moment to minimise its importance; but I should like to enquire how it happened, if the use of pure alcohol induces so much additional safety, that at the works which you told us were established in the Channel Islands, where pure alcohol was used, they had a very serious explosion; the industry there, because of that explosion, being disbanded?—The answer is that in the Channel Islands only fulminate of mercury was produced. The production of fulminate of mercury is a chemical operation which in no way affects this proposed use of alcohol in England. Using alcohol for drying guncotton merely consists in adding the alcohol to the cotton to take up the water left in by the process of making the guncotton; then the guncotton containing the alcohol is subjected to pressure, the greater part of the alcohol comes out, and the little that remains in has no detrimental effect on the manufacture afterwards. Instead of subjecting the guncotton to heat for days in a stove to dry off the water, you drive it off by the addition of alcohol. That is an operation which was not carried on in the Channel Islands.

See Q. 3577.

3634. Then you gave us to understand that your factory for the production of cordite had been stopped owing to the difficulty in obtaining acetone?—Yes, and it is at the present time stopped.

3635. Will that cause any shortage of cordite?—It is causing a great delay, and is the subject of a great deal of negotiation at the present time.

3636. A shortage of cordite may be a serious matter, and has been known to upset governments before to-day?—Yes.

Mr. A. T. Cocking.

20 Dec. 1904.

3637. (*Mr. Tyrer.*) What denaturant has occurred to you as suitable for the spirit used in this washing process; have you thought about it?—Ether would not be objectionable for cordite guncotton, but there are many things which I think could be used. The one thing which one has to consider is that it must be something soluble in water in order to take up the water and not be precipitated by it. So far as that process is concerned the denaturing material really does not matter; anything would do, because you would drive it out again. I have no doubt at all that a few simple experiments would suggest something which would be acceptable.

Alcohol in displacement process. A suitable denaturant not hard to find, *e.g.* bone oil.

3638. You say anything would do; supposing now you had ·025 per cent. of bone oil, would that affect it?—It would not be objectionable.

3639. Not with the cordite?—No.

3640. Nor with the nitro-cellulose?—Such a small quantity as that would not. You would not have more than a thousandth part of it remaining in the guncotton.

3641. (*Sir William Crookes.*) Do you speak from experience or from your own ideas? Have you tried the keeping properties of cordite and the heat test when there has been any spirit with bone oil in connection with it?—No, I have not; but you see all the spirits we add to the guncotton for the purpose of drying we remove again.

3642. (*Mr. Tyrer.*) But the bone oil could be separated by a sufficient amount of water, and therefore the first portions ultimately would have an amount of separation which would wash it out afterwards?—I have no doubt that would be so.

3643. Would it help matters if there were no objections to the use of bone oil?—I could not definitely say, but I am quite certain that if I were asked to do so I could obtain something which you would consider quite satisfactory It seems to me that the range is very large.

3644. Might I suggest, in view of the fact that application has not been made by this eminent firm under the Act of 1902—and probably this would occur to their minds after thinking over the question—that it would certainly help everybody if experiments in that direction were made? I cannot get rid of the emphasis which has been laid upon the presence of the very small quantity of impurity which gives the wood naphtha its impotability, as being a deleterious substance. The statement has been made most emphatically by at least three witnesses, that it is a dangerous thing. Now we have bone oil suggested. It may be that bone oil, in consequence of the nature of its composition, is less harmful from the point of view of nitro-cellulose than the complicated bodies which exist in wood naphtha; but it would be interesting to see, beyond the possibility of any doubt, would it not, whether bone oil really has any deleterious effect or not?—Quite so.

3645. I am only expressing my doubt, if I may, not because I know, but because of the emphatic evidence which has been given here and confirmed by yourself. Of course you have the door wide open, if you have the same strong conviction with regard to bone oil as you have with regard to the series of other denaturants which you have in your mind?—I would like to draw a line between two things—between the spirit used in a chemical operation, such as the manufacture of fulminate of mercury, and the spirit used in a mechanical operation, such as the drying of guncotton. In the latter case you practically remove all that you use, and therefore there is not the same danger. In the former case you have a chemical operation, which is much more complicated, and the effect of the denaturing material is much more important.

3646. (*Sir William Crookes.*) Of course, in using denatured alcohol as a solvent, whatever is in that which is less volatile than the alcohol would be left behind in the guncotton?—Yes.

3647. But in using denatured alcohol simply to replace the water, you squeeze almost all the alcohol out again?—Yes.

3648. And you would only leave in a very small quantity of alcohol?—That is the point.

3649. The denaturing material is not concentrated in that case?—No—not as it is at the present time with methylated spirits.

Acetone from alcohol. (*See* Q. 3616.)

3650. (*Mr. Nicholson.*) Is any acetone manufactured from the alcohol made in Germany?—I do not know whether it is made commercially, but I know it has been produced.

3651. At all events it is not worth your while to import it?—It is certainly not possible to import it on better terms than the natural acetone.

3652. Then acetone made from alcohol is presumably not an economical process?—I think that there has really not been the necessity to test that. We buy our acetone in the cheapest market, and the cheapest market is usually the place where the timber is grown, in North America.

3653. Inasmuch as you are stopped at the present moment for the want of it, and are paying fines to the Government, I presume you have enquired?—My point is, that an industry cannot be sprung up just on an immediate demand; but I am quite sure that there is no fundamental objection to producing acetone, or a solvent which would give the same result, from the oxidation of alcohol.

3654. Except the question of the cost?—I think that there the question of the cost would not be an objection. It would be possible to produce it. In Germany a material is produced and used in substitution for acetone; that is amyl acetate. Amyl acetate would do equally well for the manufacture of cordite. In Germany that can be used, but in England it is too expensive. It never has been used here, but there is no reason why it should not be used.

Amyl acetate as a substitute for acetone in making cordite.

3655. (*Dr. Thorpe.*) There is no duty on fusel oil in England, is there?—Not on the fusel oil.

3656. So you are on exactly the same terms as the Germans are there?—Yes. Do you mean why not import fusel oil?

3657. If amyl acetate will suit you, as you say it will, as well as acetone, why not use amyl acetate, which is the only thing the Germans can use apparently, or do use?—It is not the only thing, but they do certainly use it.

3658. They are subject to the same shortage of acetone as you are?—Yes, but they use very little of it, as a matter of fact.

3659. Then why cannot you turn to amyl acetate?—It is not produced in England. I do not know why, but you can only get it in Germany.

3660. (*Mr. Nicholson.*) Can you not give the Committee any idea of what would be the extreme price which you could afford to pay for alcohol, for the purpose of making acetone?—No, I cannot.

3661. Yet you suggest that the production of potato spirit should be encouraged in England for that purpose, as I understand?—Yes, I do. I think it is most important that a means should be provided for making a solvent in England. At the present time, no solvent of any description for any explosive is made in England.

Suggested encouragement of potato spirit. Potatoes a more expensive material than grain.

3662. There is no objection, as you are aware, to making potato spirit in England at the present moment, and there is no difficulty about it, because it is not prohibited in any way?—It is not a question of the duty stopping it?

3663. The question of the duty does not stop it, any more than it stops the production of spirit from corn?—Do you mean using it methylated?

3664. I do not mean that; I mean that you can make spirit from anything you please in this country?—But you cannot use the spirit, surely.

3665. Certainly you can?—When I speak of potato spirit, I mean alcohol.

3666. Of course; but the potato spirit would have to be subjected to the same conditions as the corn spirit, would it not?—Certainly.

3667. Potatoes are a more expensive material to use than corn; therefore, why do you suggest that the production of potato spirit should be encouraged?—Because it is considered, in Germany at all events, that spirit made from potatoes is much cheaper than spirit made from corn.

3668. Because in Germany there are different conditions prevailing, and alcohol there is State-aided; it is not because potatoes are the cheapest material?—I was not aware of that.

3669. (*Dr. Thorpe.*) Are you not aware that at the present moment, alcohol can be produced cheaper in

England than it can be in Germany?—No, I am not aware of that. We do not find it to be so commercially.

3670. (*Mr. Nicholson.*) That is to say, commercially at the present moment?—I think 1s. 3d. would be a fair price in England at the present time for alcohol, and 6d., in Germany.

3671 You might buy spirits in Germany for 6d., but, as a matter of fact, the price of German spirit is higher, commercially, at the present moment than the price of English spirit?—Of course I will take that from you.

3672. (*Dr. Thorpe.*) You do not know that they are actually exporting English-made spirit into Hamburg at the present time, do you?—No, I do not.

3673-4. (*Mr. Nicholson.*) German spirit is state-aided and therefore you cannot expect to be put under the same conditions as they are under in Germany?—I merely used the word "potato" in company with the word "spirit" because I was under the impression that it was cheaper to produce the spirit from potatoes than from corn; but I will leave out the word "potato" and just say "alcohol" in each case.

Methylated spirit for making ether

3675. (*Dr. Thorpe.*) You make one or two statements in your *precis* which I do not quite understand. We will confine ourselves to the powder. In the first place, you object to using methylated spirit for the manufacture of ether, as you say, "the naphtha in the methylated spirit produces no ether on distillation." Is that a fact?—Yes, is it not? I do not say that definitely.

3676. You do most emphatically—"as the naphtha in the methylated spirit produces no ether on distillation." Is there not a methyl ether produced?—Yes, methyl ether is produced.

3677. And the ethyl alcohol which is in the methylated spirit will produce ethyl ether?—Yes.

3678. So that you will have there methyl-ethyl-ether? Yes, that is so.

Solvent action of naphtha on nitro-cellulose discussed.

3679. Then you say again, as regards gun-cotton, that the naphtha has no solvent action on nitro-cellulose?—That is so.

3680. Are you prepared to assure this Committee that methyl alcohol is not as good a solvent for pyroxyline or nitrated gun-cotton as ethyl alcohol is?—I am prepared to say that you do not get the same solvent action from methylated spirits as you do from pure alcohol. That I can speak to positively.

3681. Why do you not?—I am quite certain you do not.

3682. I saw that statement in your *precis*, and I thought it such a remarkable one that I had the curiosity to test it. I have prepared a series of samples which I will show to the Committee and they can judge for themselves, because I cannot perceive any difference whatever between them. Of course as you know, some gun-cottons, such as the highest nitrated ones, are not soluble in any menstruum, even a mixture of alcohol and ether?—Quite so.

3683. But taking some that are, there is absolutely no difference that I can perceive between them. I want to draw your attention to these facts (*exhibiting samples*). This is the ethyl alcohol I used; it is 97 per cent. ethyl alcohol. Here is the methyl alcohol I used, it is of very nearly the same strength; as a matter of fact, it has a little more water in it, as it is about 95. And here is the wood naphtha, which happens to be the same wood naphtha which we have already heard something about from Mr. Griffith, who was examined before us; I think he is the manager of the Schultze Gunpowder Company. This wood naphtha came here a few days ago for us to examine it, to pass it for the Southampton methylator who supplies that gentleman with his methylated spirit. I took ten grammes of the same pyroxyline, and I dissolved it in the same relative mixture of ether and wood naphtha, namely, 2½ parts of methylated ether and one part of wood naphtha, and the same with the methyl alcohol, and the pure ethyl alcohol. Here are the results. I am not able to perceive any difference between them. What do you say?—I should like to know first what was the composition of the nitro-cotton—what was the amount of nitrogen in it, and what was its solubility.

(*See* Q. 1690.)

3684. I cannot exactly tell you that, but of course it is not hexanitrated gun-cotton, for that would not be soluble at all?—No, but we never use that cotton for smokeless powder. The cotton you used is never used in any powder; it is always a mixture which usually has about 60 per cent. of solubility; all ours has 60 per cent. of solubility; and I daresay that those results would, therefore, not apply. I am quite prepared to admit that the naphtha would dissolve the lowest form of nitro-cotton and the most readily soluble forms, but I think that could not apply with the highest qualities of nitro-cotton.

3685. *Pro tanto* it is exactly the same; there is no selective action of that kind?—My point is that you do not require as much solvent action as there is in any one of those to dissolve the low form of cotton which you used; but when you come to reach the critical point where you take a nitro-cotton—and a pure alcohol mixture will dissolve just 60 per cent. of that—surely the naphtha mixture would not dissolve 60 per cent.

3686. (*Mr. Tyrer.*) What nitration is that?—12/5 of nitrogen I am speaking of. The sample exhibited, I daresay, is from 10 to 11 per cent., and is readily soluble in almost anything.

3687. (*Dr. Thorpe.*) This is not, as I said, the highest nitrated cotton, but it is a nitrated cotton which is approximately soluble?—It is soluble in almost anything.

3688. It would not be soluble in alcohol alone, and it would not be soluble in ether alone; but it is soluble in the mixture?—I think, if I might suggest it, that that experiment should really be conducted with the methylated spirit as we use it, compared with pure alcohol, and taken on a higher nitrated cotton. Then you could see whether it would not dissolve more with pure alcohol than it would with the methylated spirit. It is a question of proportion with us. I admit that the ordinary so-called collodion cotton is soluble in almost anything. Such a readily soluble material as that would be readily dissolved even in the wood naphtha. But when you come to the higher forms of nitro-cellulose, then if you get a solution which dissolves 60 per cent. of the cotton in the one case, it does not necessarily follow that if you take another solution you would get 60 per cent. soluble again.

3689. This is a surmise of yours; the evidence so far as I have been able to go with these experiments, is that if I take a higher nitrated guncotton—that is to say, a cotton which is relatively less soluble in these menstrua—it is equally less soluble all along the line?—I do not think you should argue that.

3690. I am not arguing; I am merely stating it as a fact?—I do not see that you can say it is less soluble, provided it is absolutely soluble.

3691. If you look at them you will find that they are not absolutely soluble. A curious thing that comes out is, that as a matter of fact the wood naphtha dissolves it to the largest extent?—Can you tell, by looking at those samples, which have only ten grammes in?

3692. Turn them up and look at them?—It is a test which requires very carefully conducting.

3693. Examine them for yourself?—You must let them stand twenty-four hours in order to really tell.

3694. They have been standing for longer than that?—Not handled?

3695. These things were made on Saturday?—Of course when you disturb them, you again get them into an emulsion. But I should not be prepared to draw any conclusion from them, looking at them casually. I should say that B was much worse than A, but I do not know what these letters mean, and I do not know whether it really would be so. A great deal depends upon the way in which they were shaken.

3696. They were all kept in exactly the same position?—But they must have been shaken; I mean to say that in order to get it to dissolve we have to shake it a certain number of times and under certain conditions. In order to make a test, the Government specification should be observed if you want to determine the solubility of the cotton in the ordinary cordite guncotton. It specifies the time, the way in which it shall be shaken, and the periods at which it shall be shaken, because, after all, it is only a relative test, and the slightest variation in the method of the treatment of one compared with the other quite upsets the results.

Mr. A. T. Cocking.

20 Dec. 1904.

3697. The net result of this experiment is to prove that the nitrated cotton is as soluble in any one of these mixtures as in any other; that is the teaching of this experiment? —With the cotton you used, I admit it.

3698. That does not make any ultimate difference as to the result. If I had taken a higher nitrated cotton, I should simply, in each case, have had a larger proportion undissolved than I have now; that is the net upshot of that experiment. As a matter of fact it is most soluble of the three in the pure wood naphtha —that is to say, in the undiluted wood naphtha?—Is there anything else besides the pure wood naphtha in the methylated spirits which would affect the question?

3699. There is nothing in methylated spirit but wood naphtha and alcohol?—Is there not the mineral naphtha too?

3700. There is no mineral naphtha in that?—Nothing else.

3701. (*Mr. Tyrer.*) Only the acetones?—I was thinking of those;

3702. (*Dr. Thorpe.*) The acetones are derived from the wood naphtha; and, I believe, as a matter of fact, that in all probability the reason why apparently a little larger proportion of the guncotton has been dissolved in the case of the pure wood naphtha is due to the presence of the acetone; but in the case of the particular wood naphtha which is used for this experiment it was the same wood naphtha which has been selected by Mr. Griffith on account of its relative freedom from acetone; so there is a minimum quantity of acetone there. It was that particular wood naphtha which he stipulated for, and for which he paid a higher price. The amount of methyl alcohol there is probably over 80 per cent.?—I know from my very great experience in the chemical laboratory with these solubilities that, if I want to get a complete solution quickly, I use pure alcohol always. I can get much better solubility with pure alcohol than I can with methylated spirits; and it is the custom in a laboratory to use pure alcohol for that purpose. With a highly nitrated and partially soluble cotton—and a 60 per cent. soluble cotton is the one I have had the greatest experience of—I have not the slightest doubt in my mind that pure alcohol is a much better solvent than methylated spirit. I have proved that almost daily for years. I know how full of pit-falls this experiment is. I know the effect of handling, and I know the effect of time on the solution. I could apparently make one of those tubes appear to dissolve double the amount with the same solvent, easily.

3703. How?—By shaking it a little more; and if you had had as much experience in the testing of the solubility of nitro-cellulose as I have had, I think you would admit that.

3704. Anyhow, even from your own admission, it is quite possible, apparently, by a particular method of manipulation to get it to dissolve in what you say is the relatively least soluble menstruum?—Of course for manufacturing purposes you cannot afford to wait twenty-four hours and then shake a particular thing; you have got to conduct the operation continuously. In this case you are using in the one instance methylated spirits and in the other pure alcohol; and I undertake to say——

3705. Pardon me, I am not using methylated spirit?—I mean to say that I should be in manufacturing; I beg your pardon. If I use methylated spirit in manufacturing a thing in the one case and pure alcohol in the other, I will undertake to get 10 per cent. more solvent effect from the pure alcohol than I could get from the methylated spirit. I do not think that could be disputed, in fact.

3706. I must take that from you; but so far as the trials we have made in the laboratory go, we cannot get any corroboration of that statement?—I suggest to you to try methylated spirit with the higher nitrated cotton.

Supposed uncertain character of methylated spirit.

3707. Now I will turn to another point. You told the Committee that in your opinion a good deal of your difficulty connected with the use of methylated spirit is due to the uncertain composition of methylated spirit?—Yes, I did.

3708. Why should methylated spirit be of such uncertain composition?—The purity of wood naphtha is not considered of much importance in the manufacture, is it? It certainly varies.

3709. Are you aware of the regulations of the Board of Inland Revenue with respect to the wood naphtha which may alone be employed?—No. I am perfectly aware of the great variation of the composition of the methylated spirits which we buy.

3710. You, of course, are now re-affirming what you have just stated?—Yes.

3711. Why should there be that great variation? The wood naphtha does not vary. The wood naphtha is really a fairly uniform composition, considering that it is a mixture of liquids?—But the quantity added must vary assuredly.

3712. Pardon me, that is a matter absolutely controlled by the Excise regulations. There is to be 10 per cent. of it, and the greatest care is taken that there shall be 10 per cent. The methylating regulations, which I may draw your attention to, specify exactly what amount of methyl alcohol shall be there; they specify the maximum limit of acetone that shall be there, and they define in fact practically every necessary constituent. As the result, I may tell you that the wood naphtha that we generally get for ordinary methylated spirit is very remarkably uniform in composition. I may draw your attention to a paper which I contributed to the Journal of the Chemical Society, in which, as the result of several hundreds of determinations of the nature of wood naphtha, all these facts are set out. So that that surmise again—I can call it nothing else—which seems to be pretty general, that methylated spirit is a thing of very uncertain composition, has no foundation in fact?—Still there is no doubt it does vary. When we use methylated spirit, we have to determine its relative soluble effect before we fix the proportion, and we get very large differences in each batch.

3713. Then it must be that you are buying methylated spirits of different alcoholic strengths?—Probably.

Fulminate of mercury. (*See* Qs. 3576-84). English Excise restrictions easier than German.

3714. That is another matter, but it is a matter entirely within your own control. You have spoken about the German procedure, and you have told us that in your opinion the substances which were allowed to be used by Nobels, and the firm to which you made reference down at Faversham, produce a detrimental result as regards the crystallisation of the fulminate of mercury?—Yes.

3715. I suppose you know that in Germany denatured alcohol is required to be used in the manufacture of fulminate of mercury?—I do not know that.

3716. That is a fact, however?—Is it denatured in the same way that ours is denatured?

3717. Ours is not denatured now with methylated spirit; ours is denatured in the simplest possible way—that is to say, by the recovered products?—I think you mistake me there. I did not compare the manufacture of fulminate of mercury in England with its manufacture in Germany, but with its manufacture in the Channel Islands. In the Channel Islands nothing was added to the alcohol. I know of no manufacturer of fulminate of mercury in Germany; I know nothing about it there.

3718. You may take it from me that the manufacturer of fulminate of mercury in this country is under easier fiscal restrictions than his German competitor?—That I am quite prepared to admit; but I know the fulminate of mercury we obtain now is not as good as it was when we had it made in the Channel Islands from pure alcohol.

3719. (*Mr. Tyrer.*) Where did they get their spirit from when they manufactured it in the Channel Islands? Was it made on the spot?—I could not say.

3720. (*Dr. Thorpe.*) It is not made on the spot, is it?—No, I think it is imported.

Volatility of methylated spirit as compared with ethyl alcohol discussed. (*See ante* Q. 3563.)

3721. You told us that in your opinion wood naphtha acts injuriously in the drying of the nitrated cotton; now why should it?—The methylated spirit is not so volatile as pure alcohol.

3722. Are you sure of that?—It will not leave it. You cannot dry it out of the powder so readily; I am sure of that.

3723. Let us take that statement to pieces. Methylated spirit of course is pure alcohol *plus* wood naphtha?—Yes.

3724. Wood naphtha is from seven-tenths to eight-tenths of it methyl alcohol?—Yes.

3725. Methyl alcohol is a substance which boils at 13° Centigrade lower than ethyl alcohol ?—Yes.

3726–7. What are the other things in it ? Acetone is the other large quantity, is it not ?—Yes.

3728. Acetone boils at a lower temperature than ethyl alcohol ?—Yes.

3729. Those are substantially all the things that are in wood naphtha. What other things are there which make wood naphtha, or, in other words, methylated spirit, boil at a higher temperature than ethyl alcohol ? —You certainly are not dealing, in the case of the ordinary methylated spirit of commerce, with commercially pure methyl alcohol and ethyl alcohol.

3730. Let me point out to you what you are dealing with. As I have explained, you are dealing with methyl alcohol, you are dealing with acetone, and you are dealing with acetal ?—Yes.

3731. In fact you are dealing with products every one of which boils at a lower temperature than ethyl alcohol. As a matter of fact, if you make the experiment —if you have not done so, and if I may make the suggestion to you of actually determining it for yourself—you will find that methylated spirit is actually more volatile than pure ethyl alcohol ?—I cannot dispute that. I take your word for that.

3732. But you did. You stated that the real reason why you could not use methylated spirit—or you inferentially said it at all events—was that it was less volatile ?—I say that is an objection. I do not say it is a reason why you cannot use it.

3733. But it is not the fact ?—I am not prepared to admit that it is a fact that the methylated spirits you buy can be volatilised as readily as pure alcohol. I quite admit that it would be if made from the pure ingredients; but ordinary commercial methylated spirit I say requires far more volatilising than pure alcohol does.

3734. (*Sir William Crookes.*) Are you speaking of the bulk of the spirit or of the residue left on evaporation ? —It is the last I refer to; it is the little residues.

3735. (*Dr. Thorpe.*) What are those little residues ?—I cannot tell you what they are; but I say they exist.

3736. (*Mr. Nicholson.*) When you speak of pure spirit, what strength are you meaning ?—95 per cent. I am speaking of.

3737. Approximately the same strength, then, as the methylated spirit ?—Yes.

Acetone. Not made on a commercial scale in England.

3738. (*Dr. Thorpe.*) Now we come to the question of the acetone; is there any acetone made in England ? —Not commercially.

3739. Does not the United Alkali Company make acetone ?—Not on a commercial scale. We have had some from them. You might get a ton from them once a year, but nothing to speak of.

3740. Dr. Conroy, who was here the other day, told us that they made acetone ?—Yes, they do; but I will guarantee that the total amount produced in the British Islands is not a thousandth part of what is used. It is made to use up a by-product. Occasionally the United Alkali Company may make one ton and be glad to sell it at the price, but if you were to ask them to make two tons they would want a great deal more for it.

3741. Let me read to you Question 3225: "(*Q*) Where do you get your acetone from ? (*A*) We get it from acetate of lime, which comes from North America." That is a question addressed to Dr. Conroy himself, and his reply, of course, agrees with your statement ? —Yes.

3742. Then I asked him if he made the acetate of lime, and he said: "We do not make the acetate of lime, but we do make our own acetone. Most of the acetate we employ is American. We have used some of the continental acetate, and we have also used some English acetate, or rather Welsh acetate it is, I believe." What do you say to that evidence ?—I am perfectly sure of my facts. They are absolute facts. In England acetone is not produced except for a special purpose where the cost does not matter. I am perfectly certain that the United Alkali Company could buy acetone at half the cost that they produce it at. If they have produced it it is for some particular reason, it is not at all a commercial operation. I say that whatever their cost of production is I am sure they could buy it at half that cost. We have spent far more money in that experiment, I believe, than anyone else. We spent £10,000 on the experiment in Ireland, and then we tried it in England. There is no doubt we know far more about the production of acetone than any other manufacturer. If you say the cost is 100 per cent. more, you will not at all exaggerate, but you will be well within the mark.

Cheaper to buy than to make.

3743. The real reason apparently that it cannot be produced is, of course, as you say, that large quantities of acetate of lime—pyrolignite of lime—are imported from America, which, of course, is the fact ?—Yes

3744. Formerly pyrolignite of lime was made pretty largely in England, was it not ?—Yes.

Distillation of wood. Decrease in England attributed to lack of timber.

3745. Wood distillation in England has not gone ahead to the same relative extent as it has in America ?—No, it has not.

3746. In fact it has rather gone back, has it not ?—It has, very much.

3747. Formerly, when we started methylating in connection with the Revenue service, all the wood naphtha we required for methylating could easily be obtained in England ?—No doubt

3748. You are aware of that fact ?—Yes

3749. Why is it, in your opinion, that the wood distilling industry in Great Britain has decreased ?—There is not the wood available.

3750. Do you think that is the reason ?—I am sure it s the reason. To make a ton of acetone you want a little forest. We went into that, and tried to buy up the timber in Ireland to make that; but we found that to make a ton of acetone we wanted an enormous number of acres of forest.

3751. I suppose acetone, which has of recent years become an important thing, never was made very largely in England, was it ?—It never was made in the world to any great extent before the introduction of cordite.

3752. Quite right; that was because there was really no demand for it ?—That was it.

3753. But nevertheless large quantities of pyrolignites were used by dyers and calico printers ?—Yes.

3754. And they still are used ?—Yes.

3755. But now they are produced as a matter of fact cheaper abroad than we can produce them ?—I should imagine they are.

3756. There is really still enough wood ?—Yes.

3757. As a matter of fact the English distiller has been knocked out of court by American competition; is that not the fact ?—It would be, because Americans get their timber for nothing, and we have to pay heavily for it.

3758. Be the explanation what it may that is the fact ? —It is the scarcity of timber in England that is at the root of it.

3759. There is not an absolute scarcity ?—Of course you may put it in that way, but I say it is the question of supply and demand which regulates the price. If you had the country covered with timber you could then produce acetone; but so long as you have to pay so much for your timber you cannot, because you must have your timber free in order to make acetone in competition with the American acetone.

3760. (*Mr. Scott-Montagu.*) If I may say so, knowing something about the timber trade, timber has never been so cheap as it is to-day ?—That is so, but you must pay nothing for your timber in order to make your acetone pay.

3761. That is a big order ?—Indeed you must not; you must have a bonus on it really.

Other reasons suggested.

3762. (*Dr. Thorpe.*) Is it not a fact that the circumstances relating to a great number of other industries connected with the distillation of wood, such as the diminished demand for charcoal and the increased amount of pyroligneous acid thrown into the market from American supplies, are the real factors ?—Supposing they were, it would be just the same. But I do not admit it. I admit that it has something to do with it.

Mr. A. T. Cocking.
20 Dec. 1904.

but I still firmly adhere to my statement, which is that the real reason is the scarcity of timber. However I think it would answer my purpose just the same if I were to admit your statement for the sake of argument, and if I were to say "Yes" there. But that does not really affect the question, does it?

3763. It does. I am coming round to the point—you point out that in your opinion there is a national danger?—I do say so.

3764. The national danger, apparently, when we trace it to its source, is a scarcity of timber?—That is so.

3765. I join issue there; I say there is quite enough timber for the purpose of distillation to supply us with all the acetone we want?—Yes, for a year.

3766. Even for a longer period—sufficient to protect us from any foreign complication of that kind?—If you disregard the cost of timber, I say, "Yes, you can make acetone for a year, perhaps, and then you will have used up all your timber."

3767. (*Mr. Scott-Montagu.*) How much acetone does one ton of wood make?—A very infinitesimal amount. I could not say what amount, but I remember having a very large forest offered to me at an almost nominal figure in Ireland and I had to give it up, because there was no probability of that lasting for a sufficient while to pay for any portion of the plant. Speaking without figures, I should imagine that you would want from five to ten acres of timber in order to make one ton of acetone; I am speaking of thickly wooded ground.

3768. You can use any kind of timber for it, can you not?—Any kind of timber.

3769. Small timber as well as large?—Yes.

3770. (*Sir William Crookes.*) Could you make it from peat?—No, I do not think you could commercially. You certainly would not get such a good yield as with wood.

3771. (*Dr. Thorpe.*) You can make it from any form of cellulose?—Yes, you can. It is purely a question of yield.

Alcohol as a possible source of a substitute for acetone.

3772. (*Mr. Scott-Montagu.*) Does this not rather show that we must find something to replace acetone?—Yes, I say that.

3773. Something which would perform the same functions, but which would be cheaper?—Yes, and I suggest alcohol.

3774. You suggest alcohol as the possible substitute? Yes, I consider it is a possible substitute for timber.

3775. (*Dr. Thorpe.*) That is only on the supposition that the manufacture of this smokeless powder is going to take this particular direction—that these highly nitrated celluloses are required?—Yes.

3776. That is a question of opinion?—I am thinking of the present explosives. The explosives which are at the present time being produced could, I say, be produced from alcohol derivatives.

3777. We have some disparity of opinion from experts as to the direction which powder-making is going to take in the future?—Still, take it as you like, take it either in the present or in the future, I say that the future will demand even more than the present, but the present is a sufficiently serious question.

Finance Act, 1902. (*See* Qs 2567-74.)

3778. (*Mr. Nicholson.*) It has not led you to take advantage of the Act of 1902?—I am afraid that the Act of 1902, judging even by what I know of it now, could not offer us any relief in that direction.

3779. Have you actually read the Act of 1902?—No.

3780. Is it not rather premature, then, to express an opinion under the circumstances?—You see you must have alcohol on a very large scale and produced at the bottom price before you can begin a big industry which has to compete with acetone, which is a dying-out industry, but which is a by-product really.

3781. The alcohol industry is a pretty large one in this country and it would probably be able to meet your requirements, I think?—I daresay, but my whole point would be the question of the cost of producing the alcohol. Given alcohol, duty-free, I will undertake to provide a substitute for acetone in competition with it.

3782. Then may I suggest that you should apply to Somerset House, as you have been able to do for the last two and a half years?—Yes.

3783. (*Chairman.*) You might at any rate see what the conditions were, because you would have to pay something probably for the supervision and so on?—Yes, certainly.

3784. (*Mr. Tyrer.*) Mr. Nicholson and the Chairman have suggested what I was going to suggest to you, namely, "Try the Act." Certainly, after all you have heard, it is worth your making a carefully prepared request, in view of all the circumstances. What was in my mind some few minutes ago was this—to ask you whether you know that it is a fact that the American Government itself has begun to see the danger of the unlimited use of timber and all the waste of its timber?—Yes, I do know that as a fact.

3785. One of the present causes of the dearness of pyrolignites of which acetate of lime of course is a form, is it not ——?—Yes——

Acetone. Restrictions imposed by American Government.

3786. Is due to some extent to coming events throwing their shadows before, so to speak, and the possibility, in fact the high probability, of restrictions upon the unlimited destruction of timber taking place in America as elsewhere?—I do not think the present increase is due to that. It has been so very sudden and the cause is so self-evident, namely, that there is none to buy. There is a danger, and a very serious danger, from what you say, and we have been informed during the past twelve months that all our contracts in future with America for acetone will be subject to the American Government not requiring the acetone for their own use, and that at any time without any other cause being given, our acetone contracts may be broken if the American Government want it or refuse to allow it to be exported. That is a danger which never has met us before.

3787. (*Sir William Crookes.*) They may want it for their explosives?—Yes, and there is also a possibility of its being required for the manufacture of artificial indigo, I believe; but I suppose it is for explosives that the American Government really want it. In that case we should be in a much worse position even than we are now.

3788. I think you may take it from me that cordite will be the main explosive in the British Empire for a great many years?—Yes, I quite believe that in the case of our Government.

3789. Pyro-collodion is not so popular in other countries as it was at first, is it?—No.

Method of making acetone abroad

3790. (*Dr. Thorpe.*) Do you know whether acetone is made on the Continent indirectly from acetic acid made from alcohol?—I know of one case where it was so made, but I am bound to say that that one case was a failure ultimately, and we had the plant offered to us. I do not know how acetone is made on the Continent, with that exception. I only know that it is made on the Continent.

3791. There are only two ways, so far as I know, of making it—either indirectly from acetic acid made by the oxidation of alcohol or from pyroligneous acid?—I know that it has been made in Germany from the oxidation of alcohol, but I do not know to what extent. I know that a quantity of acetone is produced in Germany, and I should imagine that it is produced from the oxidation of alcohol. I know that in America it is produced entirely from wood.

Mr. ALBERT THOMAS CLARKE, called; and Examined.

3792. (*Chairman.*) You represent the Hentschel Colour-type Company, Limited, do you not?—Yes.

3793. Are they a London company?—Yes, they are a London company, with works at West Norwood.

3794. What is their business?—Their business is that of colour process engravers.

Collodion. Its manufacture from duty-paid spirit and methylated ether.

3795. Your interest in this question of duty-free alcohol is largely, if not wholly, confined to the manufacture of collodion, is it not?—To the manufacture and the use of collodion.

3796. Do you use large quantities of it?—The process as regards the photographic portion is practically exclusively the wet plate process, that is the wet collodion process.

3797. Do you make your own collodion?—We do.

3798. How do you make it now—with methylated spirit?—No, with absolute alcohol.

3799. Paying the duty?—Yes.

3800. In what sort of quantities are you using the spirit? Are you using very large quantities?—There are two other large and allied branches under Mr. Hentschel's chairmanship. On the colour side we use about two gallons a month.

3801. Is your ether made from pure spirit?—No, it is methylated ether, and we buy it as washed ether.

Quantity of duty-paid spirit used by individual traders is not large.

3802. Then the total amount of alcohol which you use and pay duty on is quite small?—Yes, it is; but I believe Mr. Hentschel has been approached as a representative of the trade, and the amount used by the trade would no doubt be large, although it is individually small.

3803. Your company, I suppose, is one of the largest members of the trade?—Yes, it is one of the largest.

3804. Therefore what they use could be taken as fairly representative of what individual traders would want to use?—Yes.

3805. That is twenty-five gallons a year or thereabouts. Then the only difference it would make to you would be the duty on twenty-five gallons, which would be perhaps £25, this being a strong spirit?—I am only speaking for my own branch. Through the firm it would be at least three times that amount, if not rather more. I am individually acquainted with the details of only one branch, and I cannot speak positively to the others.

Collodion emulsion (*See* also Q. 3828).

3806. But still it is a comparatively limited quantity. I will not ask you questions on the second and third heads of your *precis*; I will leave those for the scientific members of the Committee. Coming now to your fourth heading, you suggest that the premises should be bonded; what premises would those be—the premises in which the collodion is made?—I was speaking more particularly of the manufacture of collodion emulsion there.

3807. Collodion emulsion comes into this country in the form of a dry powder, does it not?—Unless it is made. We make it for ourselves.

3808. Then do you not reduce it to powder?—Yes, we do.

Importation in form of powder.

3809. When it is imported in the form of dry powder, is it liable to duty?—It is simply imported as dried collodion, and it is in the form of a dry powder. Schering's celloidin is another form of collodion or pyroxyline. So far as I know, it comes in free.

3810. Has not alcohol been used in the making of it?—Yes, but it is not made as a trade article in England. Such brands of it as come to England are imported from Germany.

3811. What is it imported as? What is it called when they pass it through the Customs; what do they say it is?—I presume it is called collodion emulsion powder. We buy it from factors, and in point of fact we do not import it. We manufacture our own, purchasing only small quantities.

3812. (*Mr. Tyrer.*) Is it a powder?—It is a dry powder.

3813. (*Dr. Thorpe.*) It is called collodion, is it not?—It is called collodion emulsion powder; that, I believe, is the title on the box.

3814. Is not collodion in the tariff, whether it be in powder or whether it be more or less liquid?—No; collodion is the liquid vehicle. *Mr. A. T. Clarke.* 20 Dec. 1904.

3815. If it is designated to the Customs as collodion powder, does it not attract attention?—Possibly, but it is not collodion. It might come in as pyroxyline, if there is a duty on pyroxyline.

3816. (*Chairman.*) Your own firm now manufacture collodion, but supposing collodion had to be manufactured in bonded premises, how would that affect you?—We should purchase it.

3817. Would you always purchase it?—Yes; that is as regards plain collodion.

3818. Do you not purchase now?—Not in my own branch.

Collodion made from methylated spirit. Its disadvantages.

3819. Throughout the trade a great deal of collodion is used that is made with methylated spirit, is it not?—A proportion is made with methylated spirit, but I believe that few commercial collodions are made entirely with it because they give too much trouble.

3820. In what way?—They foul the silver-bath and you cannot get the same class of negative. The dot in the half-tone process has ragged edges instead of cleanly and sharply-defined edges.

3821. (*Dr. Thorpe.*) But a certain proportion of methylated spirit apparently is used—not wholly methylated, but say half and half?—Taking Mawson's collodion, which is a standard collodion for process engravers, that does foul the silver-bath, and I have always taken that personally as a proof that it does contain a certain amount of methylated alcohol.

3822. But you have no direct positive knowledge other than that?—I have no direct positive knowledge that it does do so.

3823. You know it contains methylated ether, I suppose?—Yes.

3824. It is bound to do that?—It is almost certain to do so; it could not be sold at the price otherwise.

3825. You think it is a mixture of pure spirit and methylated alcohol?—Yes. If I make collodion with old formulæ methylated alcohol, I get the same defects that I get from Mawson's collodion. I am speaking of Mawsons as standard makers of collodion.

3826. They have a great reputation as collodion makers, have they not?—They have a very great reputation. It is the standard English collodion.

3827. And yet it contains methylated spirit, you say?—It contains a proportion of methylated spirit, to my idea.

Suggested manufacture of collodion emulsion in bond.

3828. (*Chairman.*) When you suggest that collodion should be made in bond, you are not speaking as one of the people who would make it in bond, but as a user of collodion which you think might be made by somebody else in bond?—Perhaps I may explain why I put that in. We were the first people to exploit collodion emulsion in England, in fact we were making it for our own purposes and using it for this colour process work previous to Dr. Albert putting the article on the market. We could, no doubt, if it was not prohibitive, make arrangements with factors to supply this to photographic engravers generally, and we should prefer to do so. We should prefer to be rid of the actual bother of making it. For one thing, it could be made at a lower price than when made in a comparatively small way. At the same time it might be a source of profit to us to sell it to the trade generally. It is an admitted fact among them that the collodion emulsion for this process work is infinitely superior to wet collodion, and it is also infinitely superior in regard to this new tri-colour work to any other method that has yet been put on the market.

3829. How do you use the powder?—The powder is dissolved in a mixture of alcohol and sulphuric ether.

3830. Do you have to use alcohol to dissolve it?—Yes.

3831. For that do you use pure spirit?—Yes.

3832. A duty-paid spirit?—Yes.

Mr. A. T. Clarke.

20 Dec. 1904.

3833. Do you use any very large quantity of alcohol now?—It would, approximately, be about the same quantity used for dissolving that is used in the manufacture.

3834. You said, just now, as I understood, that if it were not prohibitive you would establish a trade in this?—In what way prohibited?

Competition with German article at present impossible.

3835. Perhaps I misunderstood you, but I thought I understood that you had started the manufacture of collodion emulsion in the form of dry powder, and that then you went on to say that if the conditions as regards alcohol were not prohibitive you would be able to do a large business in manufacturing and selling it to other traders?—We should attempt to do so, most certainly.

3836. Did you not use the word "prohibitive"?—I did not say we were prohibited. I consider that we could not compete with the German article at the moment.

3837. Under your sixth head you say that you have not taken any steps to get over this difficulty beyond making an inquiry as to whether pyroxyline could not be considered as a denaturing agent. Can you remember when that inquiry was made?—That was not made direct to Somerset House; it was made through a firm of manufacturing chemists, whom we approached in the matter to see whether they would not take up the manufacture of this collodion emulsion.

3838. You did not come direct to us then?—No, we did not.

Excise supervision necessary with duty-free spirit.

3839. Supposing you were allowed yourselves to have a certain amount of duty-free pure spirit for the manufacture of collodion, could you control the use of that spirit, do you think, in such a way as to protect the Revenue and prevent its being improperly used?—I think so. At the present moment the whole of the work is done by a chemist who is in the nature of a confidential agent. He holds formulæ of a secret character, and all spirit is locked and all matters appertaining to it are locked in his laboratory.

3840. As you use duty-paid spirit, you naturally are very careful of it?—Naturally.

3841. Therefore, the arrangement that you now apply yourselves in your own interests for the protection of that duty-paid spirit, would perhaps suffice for the protection of the Revenue, if you were using duty-free spirit?—We are very careful to permit no one to enter these premises, so that they shall not surprise any of our formulæ, or apparatus which we use, or methods.

Cost of supervision only justified by manufacture on wholesale scale.

3842. You would have to have a substantial amount of supervision if you were using duty free spirit; even comparatively small quantities of spirit would require supervision, because if there were a very large number of people each using a small quantity, that might mean a large quantity of spirit in the aggregate; therefore, each user might be subjected to a certain amount of supervision and control for which he would have to pay. Do you think that using quite a small quantity of spirit, like 50 or 100 gallons in the year, it would be worth your while to pay for that supervision?—Not as photo-engravers, but it would as manufacturers of collodion, or rather of collodion emulsion.

3843. But only if you did it on a considerable scale?—Only if we were manufacturers for the supply of other houses.

3844. (*Mr. Tyrer.*) I think you used the word "combined" manufacture, or something equivalent to it; was what was in your mind manufacturing in combination, or the production of this collodion emulsion in combination, at a sort of central depot?—My reference in my *précis* as to whether pyroxyline could not be considered a denaturant was addressed to a firm of manufacturing chemists to know if they could take up our formulæ and manufacture it for us, and sell it to other photo-engraving firms under a royalty. That was our proposal, and they said it was prohibitive, and they, therefore, could not compete because they understood from us that absolute alcohol was quite essential. I have attempted to use even a small proportion of methylated spirit, and I have found that it is quite impossible.

3845. Of course you gave them the formulæ for the absolute alcohol?—We simply told them that they would have to use absolute alcohol.

Pure methyl alcohol as a possible denaturant.

3846. The Chairman has referred to denatured spirit; has anything been suggested to you which could be added to the spirit used for making this emulsion which would make it positively impotable and yet not injure your processes?—Does methyl alcohol answer the purpose?

3847. (*Chairman.*) No, not if it is quite pure?—I am of opinion that pure methyl alcohol would not be detrimental, but I understand now that it is not sufficient.

3848. (*Mr. Tyrer.*) It is dutiable?—Can pyroxyline then be considered, even if it is of an expensive character?

3849. (*Dr. Thorpe.*) It is not an objection to the use of pure methyl alcohol that it is dutiable under the concessions. You, I understand, say that in your opinion pure methyl alcohol might be used to admix with the alcohol?—Yes.

3850. You think it would have no detrimental effect?—I do not think a pure methyl alcohol would, but I have not made that experiment, because I have always understood that it was out of the question, and that it had been refused by the Excise authorities.

3851. Although it might not make the alcohol undrinkable, nevertheless the presence of methyl alcohol might serve to indicate that it was duty-free alcohol?—Yes, it might be made to serve that purpose from the Excise point of view.

3852. (*Mr. Tyrer.*) As Dr. Thorpe would probably explain to you, the object of putting wood naphtha in the spirit is to ear-mark it, so to speak, so that it can be traced, no matter what is done with it; and if a certain proportion of pure methyl alcohol added to the pure alcohol would answer your purpose—and you see no reason why it should not—then, as Dr. Thorpe says, that might be followed and traced?—My personal opinion is that it would not be detrimental, but I frankly admit that I have made no experiments to justify me in that.

3853. (*Dr. Thorpe.*) Have you had any experience of wood naphtha at all?—Only in methylated spirit, not as a separate and distinct spirit.

Suggestion that a high grade wood naphtha might meet the case.

3854. You could not say, for example, whether the character of wood naphtha would suit you until you had actually tried it?—No, I should have to put it to the test of actual experiment. My chemical knowledge would not go far enough to enable me to say without that. Pure methyl alcohol is nearly odourless, is it not?

3855. There is some methyl alcohol which has a very slight smell?—(*Specimens handed to Witness.*)—I am afraid my nose is not expert enough to guide me.

3856. Of course there is a difference in the smell?—Yes, there is a difference, and, strangely enough, the second one seemed to me to have a very faint benzene odour.

3857. It has not really any benzene in it?—That is what made me hesitate.

3858. The point about that is this—this is, I will not say, pure methyl alcohol—it is a commercial article, such as is used under particular concessions by methylators, and you can purchase this in methylated spirit?—Is that the methylator, or is that the methylated spirit?

3859. *That* is a sample of the wood naphtha of which 10 per cent. is added to the methyl alcohol, and *this* is a sample of very nearly pure or relatively commercially pure methyl alcohol, containing, I believe, only about 1 per cent. or so of acetones. Do you know what it is which affects you when, as you say, after a time the bath gives you trouble? Is it due to something in the methylated spirit?—I personally presumed that it was something in the nature of impure gums or something of that sort.

3860. There is nothing of that kind in such methylated spirit as you could get, and certainly not in such as Mawson's use. Probably you think there is some thing in the nature of finish in it, such as a solution of shellac or similar gums?—I admit that was in my mind and has always been in my mind. I am not an expert chemist.

3861. Let me assure you that the kind of methylated spirit that you would get from Mr. Tyrer, if you went to him, or that you would get from any methylator, or that you incidentally get in your collodion from Mawson and Swan, contains nothing else than alcohol capable of being distilled without leaving any residue, mixed with 10 per cent. of wood naphtha of an approved char-

acter, which also distils without leaving any gum or anything of that kind. That is the nature of the methylated spirit that you can use; so there is nothing in the nature of gum, and certainly nothing in the nature of petroleum, as you seem to think, in it?—There is no petroleum naphtha; that I know.

3862. And there is no methylated spirit which is methylated with petroleum alone, although you thought there was, apparently?—I understood that the ordinary methylated spirit of the ordinary oil shops was methylated with petroleum naphtha.

3863. Alone?—Yes, I understood so.

3864. That is not so. It is exactly the same methylated spirit, except that in that which is sold retail in the oil and colour shops there is three-eighths of 1 per cent. of petroleum added; that is all. But you did not know that as a fact?—No, I was not aware of that.

3865. (*Mr. Tyrer.*) I gather from your *précis* that you have reason to believe that not wood naphtha, such as Dr. Thorpe has referred to, but pure methyl alcohol might answer your purpose as well as the pure spirit?—Yes, but I must admit that that opinion is shaken now that Dr. Thorpe has told me of the character of the methyl alcohol. I had always understood that it was an extremely crude spirit, which was intentionally used so as to make it more objectionable for drinking purposes, but if it is of the high grade that Dr. Thorpe mentions, I must admit that there is something evidently in the methyl alcohol itself that would render it quite impossible for use in collodion emulsion.

3866. (*Dr. Thorpe.*) I do not quite understand this; do you withdraw your belief that methyl alcohol could be used?—It was an opinion; it was hardly a belief.

Mr. A. T. Clarke.

20 Dec. 1904.

3867. Do you retract that opinion?—I was under the impression that the methylator used was an extremely crude spirit, but you tell me now that it is for all practical purposes a pure spirit.

3868. No, pardon me; I did not say that. What I did say was that this particular kind of wood naphtha which I drew your attention to was allowed to be used for special purposes, and that it might be equally open to you to ask for permission to use this if you are starting that manufacture, just as it was for the particular persons who do use it?—I understand now.

3869. This all arises from your suggestion that possibly the alcohol might be ear-marked by means of methyl alcohol. Now, of course, methyl alcohol, absolutely pure, is a relatively expensive material, and you would have to pay something like 6s. or 7s. per gallon for it?—Yes.

3870. I point out to you that a wood naphtha can be obtained of a very high degree of purity, which, it is conceivable, if you ask under the 1902 Regulations, you might be permitted to use, just as the manufacturers of nitro-cellulose powders are permitted to use it?—I see. Would that be obtainable from the usual sources, such as a distillery?

3871. Methyl alcohol is not made at a distillery?—No: but there are people who have the right to sell methylated spirit who methylate it on their premises under bond.

3872. No doubt there are?—Is that merely what I have called the old formulæ, or could I specify a very high grade of methylator in ordering it, provided I had the Excise authority to receive it?

3872A. You could take the same procedure as was adopted in the case of the special methylated spirit which was allowed to be used in the manufacture of nitro-cellulose powders?—Thank you.

TWELFTH DAY.

Tuesday, 3rd January, 1905.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair*

Professor SIR WILLIAM CROOKES, F.R.S.
Sir W. H. HOLLAND, M.P.
The HON. J. SCOTT-MONTAGU, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. W. SOMERVILLE.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*).

Mr. WILLIAM MANDEVILLE EDWARDS, called; and Examined.

Mr. W. M. Edwards.

3873. (*Chairman.*) You are, I believe, a director of Christopher Thomas & Brothers, Limited, Soap Manufacturers, Bristol?—Yes.

3874. You have been President of the Bristol Chamber of Commerce?—Yes.

3875. Do you come as a representative of the Bristol Chamber of Commerce on this occasion?—I think I may say so.

3876. Have you been formally deputed by the Chamber of Commerce?—I do not recollect whether there was any actual resolution passed to that effect, but I was asked informally some time ago to give what information I could on the subject.

3877. (*Sir W. H. Holland.*) I think your name was sent in in reply to a communication from Mr. Fithian, of the Associated Chambers of Commerce, so that you would be deputed?—Yes, I think that was the case.

3878. (*Chairman.*) Do the firm of Christopher Thomas & Brothers manufacture anything besides soap?—Yes, we make candles and glycerine, and we also make two edible fats, the one an edible cotton oil and the other an edible oil chiefly from cocoanut oil for chocolate making.

3879. Is the soap manufacture the main part of the business?—Yes.

Soap.

3880. In connection with that part of your business, are you at present using alcohol for the transparent soap?—No.

Alcohol not used in this branch of witness's business.

3881. Have you done so in the past?—Yes.

3882. You say in your *precis* that methylated spirit cannot be used for the purpose, as it would give the soap a nasty smell; but as a matter of fact methylated spirit is used to a very large extent in the manufacture of soap, is it not?—I do not think so. We have made scented soap with methylated spirit, and have kept the soap for, I think, about two years, and then found that it still had a strong smell from the methylated spirit. I, personally, do not know of any method of using methylated spirit in soap making by which you could get rid of the smell.

Methylated spirit considered unsuitable.

3883. Do you know that Messrs Pears, for instance, who, I think, are the largest manufacturers of transparent soap in the world, use methylated spirit?—Then they know something I do not—I confess that.

3884. I believe that ever since they began, they have never used pure spirit?—I was not aware of that. We

Mr. W. M. Edwards.

3 Jan. 1905

used to use pure spirit with a high-priced toilet soap years ago.

3885. As a matter of fact the transparent soaps are not in such demand as they used to be, are they?—No, from our point of view the spirit in soap is not really an important matter. The other point about the edible fats is much more important. I only put in the reference to soap because the matter was up; but it is not a very important thing for us, and I do not suppose it is an important thing for the soap trade either.

3886. Then, in fact, as matters stand now in the trade, even if you could get pure alcohol duty free, it is very doubtful whether you would use very much of it for the soap?—I should say we should certainly not use very much of it, but if we could use it conveniently we should do so.

Finance Act 1902. Advantages not worth the expense as regards soap.

3887. Are you acquainted with the provisions of Section 8 of the Act of 1902?—No.

3888. That allows, in certain circumstances, duty-free alcohol to be used under more or less supervision; therefore it would be possible even now perhaps for you to use the alcohol duty-free. Would you care to do so under supervision, paying something for that supervision?—I do not think as regards soap it would be worth while going to any considerable expense over it.

Edible oil for biscuit making, prepared from cocoanut oil.

3889. Then, as regards the edible oils to which you refer in your *precis*, what do you use as a solvent now?—As a matter of fact, we cannot make that class of edible oil.

3890. Is what you make cocoa butter?—It is a substitute for cocoa butter that we make.

3891. Do you extract it from the cocoa bean?—No, it is made from the cocoanut oil that is pressed out of the fleshy part of the cocoanut, and it has nothing to do with the cocoa bean.

3892. Then it has nothing to do with the manufacture of cocoa butter?—No, but the cocoanut oil can be prepared in such a way that it can be used to a great extent as a substitute for the genuine oil from the cocoa bean.

3893. Are we to understand that you cannot attempt to make that now?—We can make the substitute for cocoa butter, but we cannot make the soft oil which is used for biscuit making.

3894. Is that sort of oil now being imported, then?—Yes.

3895. Do you know for certain that in making that, foreign manufacturers do use alcohol?—I only know it by report, but I am practically certain of it.

Alcohol believed to be used in its manufacture in France.

3896. You say that it is made in Marseilles by Messrs. Rocca, Tassy et de Roux?—Yes. Of course it is difficult for a person in a trade to get hold of the exact means that another man, his business competitor, is using. I thought it was possible that you could verify my statement, but I would not have put that statement forward if I had not been as certain of it as I could be.

3897. In France they are sure to be subjected to a considerable amount of regulation, and they do not always get off the whole of the duty?—I understood that they did.

3898. (*Dr. Thorpe.*) And even then they apply a denaturant to the alcohol which is something in the nature of a substance analogous to wood naphtha, and in many cases is actually wood naphtha?—I do not see how they could denature with wood naphtha any alcohol that was to treat an edible substance. It would be very difficult to get rid of the taste.

Methylated spirit found unsuitable. (*See* also Qs. 3937–51).

3899. Have you tried?—I have tried a good many experiments, but they have not been successful.

3900. Have you actually made the attempt to use methylated spirit as we make it?—Yes, we have used methylated spirit.

3901. And you have found that the results were unsuitable?—Yes, we could not do with it.

3902. (*Chairman.*) Is the only difficulty in your way of entering upon the manufacture of this edible oil, the difficulty about alcohol?—That is the main difficulty, I think. If we could use alcohol, I think I know sufficient about the rest of the way of preparing the oil to be able to do it. I have tried a good many ways of preparing the oil so as to do without the alcohol, but I have not succeeded in doing it.

3903. The existing law does give you the opportunity of obtaining duty-free alcohol other than methylated alcohol, but possibly we should have to ask you to do something to protect the alcohol by making it unpotable, or, in the last resort, you might be permitted to use it absolutely pure if you subjected yourselves to pretty constant supervision by an Excise officer. Do you suppose that it would be possible for you to conduct this manufacture separately from the rest of your business, so as to be able to subject it to supervision?—Yes, I think so.

Finance Act 1902, its provisions probably adequate to meet the case.

3904. If you were prepared with a scheme, and knew exactly what you wanted to do, there is nothing to prevent your making an application to the Board of Inland Revenue now to obtain leave to use duty-free alcohol; then we should have to consider whether the circumstances justified us in giving that permission, and under what conditions?—I did not know that. When I went into the question, which was about three years ago, I think, I understood that I would have to pay the duty.

3905. At that time you would. Do you conceive that a large business might be done in that and similar ways?—Yes, I am sure it would; that is to say, I know there is a very large business done in the class of oil which these Frenchmen send to England. My firm made an oil which was almost as good as theirs, but by another process altogether. However, we could not get the lack of flavour which they have; theirs is absolutely tasteless, whereas ours had just the least little taste of cocoanut oil left in it. To the best of my belief, the reason why they were able to do it and why we were not, was that they were able to use the alcohol process of refining.

3906. In the process is much of the alcohol recovered?—I believe so. Of course, every manufacturing process would lose a little alcohol, but I do not see that there is any reason why the great bulk of it should not be recovered every time it is used.

3907. What quantity would be required?—With regard to the quantity, we have never been able to try it on a large scale. As you know, things work quite differently on a large scale to what they do in a laboratory, so I really could not tell you; it would be a mere guess as to what quantity would be required.

3908. Have you yourself carried out laboratory experiments on this question to any great extent?—No; I am not a chemist myself.

3909. Do you know whether any other firms have been at work upon this question of the production of edible oil? Yes; There is a firm named Crosfield, of Warrington, who make an edible oil very like the French, but I believe they carry it out in a totally different way.

3910. Do they use alcohol?—No, I do not think they do, although, of course, I do not know their process.

3911. It really is rather a question for the Board of Inland Revenue under the existing law. If your firm desire to undertake this manufacture and would come to us with a scheme and tell us exactly what you want to do, we could consider the matter. But if we allow you to use alcohol in a state of considerable purity, there will have to be greater supervision—in fact, the purer the alcohol the greater the supervision and therefore the greater the cost to you of supervision. Still, a great deal is possible under the existing law, and if your firm would like to make a proposal it can be considered?—I will go into that. I thought that the manufacture was practically stopped by the duty.

Quantity of alcohol likely to be used.

3912. Not necessarily so since the Act of 1902. Have you any idea of the quantity of spirit that you would require to have in your factory at any one time; would it exceed 1,000 gallons, for instance, or be as much as 1,000 gallons?—I imagine that you would have to work an article of that sort in lots of about ten tons of oil at a time, and I suppose, at a very low estimate, you would require a ton of alcohol to work with that. That would be something like 250 gallons, reckoning 9 lbs. to the gallon.

3913. (*Mr. Nicholson.*) How strong would the spirit have to be?—I think it would require to be either proof or a little over proof, but I am not certain about that.

3914. (*Chairman.*) Then the total quantity of alcohol that you would require on your premises at any one time would not be very large; but of course you must have more than 250 gallons, because there would be a loss every time?—Yes.

3915. Probably if you had 500 gallons on your premises at any one time, that would give you a working strength of alcohol ?—Five hundred to 1,000 gallons, I should think, would.

Comparatively few men likely to be employed.

3916. (*Sir W. H. Holland.*) Is this edible oil industry a very large one ?—Yes, it is.

3917. Does it, do you imagine, give employment to much labour ?—I should think not. I should think you could work a very fairly good turn-over with about half-a-dozen men, or something like that.

3918. Then, from the point of view of the employment of labour, it is not very important ?—No, I should not think it would be much.

3919. (*Sir William Crooks*). What is it principally used for ?—Biscuit making.

Importation of the oil into England and purposes for which used.

3920. In your *precis* you say this Marseilles firm prepare about 800 tons of the oil per week ; does much of that come over to England ?—I think so. We had agents in Glasgow, where they make a lot of biscuits, who used to sell our cocoa butter substitute for us, and they gave up being our agents because we could not make this biscuit butter for them. They told us that they could sell it easily in lots of fifty tons at a time. They were making a very fair commission out of us by selling to chocolate makers, but they gave us up for this other business, because they could not run the two things together. Then I heard that Huntley & Palmer's and other biscuit makers further south used very large quantities of the oil.

3921. Do you know whether it is used in making butter substitutes ?—I do not think so. I have suspected it once or twice in butter, and I have had samples of butter examined to see whether they had any in them, but we could not find that they had.

3922. (*Mr. Scott-Montagu.*) Is any of it used in margarine ?—Yes. This very morning I was told that there is a man in Belgium who uses very large quantities of purified coconut oil in his margarine. He is said to turn out about 500 tons of margarine a week. I do not know what proportion of coconut oil he would have in it.

3923. (*Chairman.*) According to the trade returns, the import of coconut oil from France has been rather diminishing. There were 25,000 cwts., that is, 1,250 tons—which came in in 1902, and in the next year, 1903, there was only half that quantity—namely, about 600 tons ?—There must be some mistake there, because it comes in by thousands of tons.

3924. I have given you the figures for France only. Would it come in under the description of coconut oil ?—No ; I should say it comes in under the description of some sort of butter or substitute.

3925. (*Dr. Thorpe.*) You are speaking of the raw oil, are you not ?—Yes ; I thought the Chairman was speaking of the raw oil.

3926. (*Chairman.*) Is this article that is manufactured in Marseilles a solid ?—Yes.

3927. It is no longer in the form of oil, then ?—Coconut oil is solid at the English temperature. It melts at about 70 degrees.

3928. (*Dr. Thorpe.*) It is largely used in candle-making, is it not ?—It used to be, but it is too expensive now to be used for that purpose.

3929. (*Sir W. H. Holland.*) Do you say that this industry at the present time is practically non-existent in this country ?—I do not say that. This firm of Crosfields of Warrington make a prepared coconut oil which does compete with the French, although it is not exactly the same.

3930. Of course, if the industry were at the present time non-existent, then no concession on the part of the Revenue authorities would lead to a loss of Revenue ?—It is non-existent in the sense that the oil is not prepared by alcohol.

3931. (*Chairman.*) In fact, no spirit revenue is derived from alcohol used in the industry at the present time ?—As far as I know, I do not think there would be.

3932. (*Sir W. H. Holland.*) Therefore, the making of a concession would involve no loss to the revenue authorities ?—No.

3933. (*Mr. Nicholson.*) Do you anticipate that if you had a large trade you would not employ more than six hands ?—I should think that with six men you would turn over a good quantity.

3934. Then the question of the safety of the revenue is not a very large one, because you would only have to safeguard it against those six men ?—Yes, I think that would be the case.

Little difficulty in protecting Revenue if manufactured under Finance Act, 1902.

3935. And you would not anticipate any great difficulty in doing that ?—No, I do not think there ought to be much difficulty in that.

3936. Neither as a question of the men's own consumpton, nor as a question of their taking it off the premises—because you must remember that there would be a great temptation to take duty-free alcohol off the premises, if, when they have got it outside, it is worth 11s. per gallon more ?—I have worked in a distillery, and I know just what the temptations are. I should think there would be no more difficulty in guarding it than there would be in an ordinary distillery ; and, of course, it would be kept in a much smaller compass.

Suitability of methylated spirit. (*See ante* Qs. 3899-3901). Experiments with mineralised quality not conclusive

3937. (*Dr. Thorpe.*) You say you do not profess to have chemical knowledge yourself, but have you anybody in your works who is able to conduct chemical experiments ?—Yes.

3938. Have you a chemist connected with your works ?—Yes.

3939. Did he make the trials with methylated spirit for you ?—I will not be quite sure what individual did it, but we have got several chemists, and several partners who have more or less chemical knowledge without being expert chemists.

3940. Did you entrust the trials as to how far methylated spirit could be used to those experts and the gentlemen you have mentioned ?—Of course, anything that they have done for us has been entrusted to them, if that is the point of your question.

3941. The point of my question was what skilled advice you had to enable you to assure yourselves that methylated spirit was, as we say, unsuitable and detrimental ?—Our chemists are fully qualified men. They have passed a great many examinations.

3942. Did they undertake the trials for you ?—Yes.

3943. Do you know what kind of methylated spirit it was that they used ?—No, I do not.

3944. On what scale was the trial made ?—On quite a small scale.

3945. With methylated spirit purchased where ?—In Bristol.

3946. In a retail way ?—When we want methylated spirit we have usually bought it about a couple of gallons at a time. That is what we are allowed to buy, is it not ? Is there not some Excise regulation that we are not allowed to buy more than two gallons at a time unless we have got some licence ?

3947. Unless you have a permit. You bought without a permit, then ?—I believe that our purchases are generally about two gallons at a time, because we use methylated spirit for other things.

3948. I venture to think that you must have bought the ordinary retail methylated spirit ?—Yes.

3949. Which contains paraffin oil ?—I did not know that.

3950. And you concentrated, no doubt, that paraffin oil in your product ?—Yes, no doubt.

3951. Perhaps, therefore, the detrimental character of it, and its unsuitability might be due to the admixed paraffin oil ?—If the paraffin oil were there, I dare say it would destroy the value of the edible oil.

Suggestion that a special quality of unmineralised methylated spirit should be tried.

3952. I venture to say that under the circumstances your experiment was scarcely a valid one. You are not aware that you have some control yourselves even ver the character of the methylated spirit ?—No.

3953. Supposing that you bought the methylated spirit which is used for industrial purposes under the special circumstances which the Chairman has indicated to you, then you could yourselves practically exercise some control over the nature of the methylated spirit you bought ?—I did not know that.

Mr. W. M. Edwards.
3 Jan 1905.

3954. In other words, you could get, if you paid for it, a methylated spirit which was largely free from what you think the noxious and hurtful products which are associated with the ordinary retail methylated spirit?—That is very useful information to me, and I am very much obliged to you for giving it to me.

3955. You were not aware of that?—I did not know it.

3956. (*Mr. Tyrer.*) Your experiments were made with the ordinary methylated spirit?—Yes.

3957. Bought in the ordinary way, and as far as you know, with naphtha in it?—Yes.

Finance Act, 1902. Its scope not fully realised

3958. Might I ask you whether you knew of the existence of the Act of 1902?—I did; but I now think without very much realising it.

3959. I asked that question, because it is part of an unfortunate experience that a great deal of, what shall I say—fuss, for want of a better word—is made about facilities. An Act was passed with the deliberate intention of giving facilities, good cause being shown, and you, among others, have evidently forgotten that there was such an Act passed for the benefit of manufacturers, However, that does not alter the fact that facilities have been given, and may still be given; but it is a curious thing that where alcohol is so necessary in a process in which you have competition from Marseilles, so little inquiry should have been made. In that part of your *precis* dealing with the manufacture of soap, you say that your soap was "made transparent by another process which is not so satisfactory." I suppose that is also true of a large class of transparent soaps which are made on the Continent without spirit—that they are not so good as those in which spirit has been used?—I should suppose so.

Transparent soap. Inferiority of that made without alcohol.

3960. We have had it in evidence, if my memory serves me aright, that it is not absolutely necessary to have spirit in order to make soap transparent?—It is not.

3961. But that transparent soap made without spirit is exceedingly caustic and is an inferior article in every respect; should you say that is so?—I should not say that it is necessarily very caustic, but it is inferior to look at, and it is not such a high class article.

3962. Does it keep as well?—No. The one made without spirit I do not think improves on keeping; but the one made with spirit does improve on keeping.

3963. Of course you are aware that there is a duty of 3d. per pound on all transparent soap imported into this country?—If it has spirit in, I believe.

3964. Does the 800 tons of edible oil you have spoken of as being made in Marseilles come to England?—I do not say that the 800 tons come here. I say that a firm in Marseilles are making that quantity per week, and I know that large quantities of it are used in this country. Our Glasgow agents, I knew, used to sell fifty and more tons of it at a time. That is a good large quantity of edible oil to sell at a time.

Mr. THORP WHITAKER, called; and Examined.

Mr. T. Whitaker.

3965. (*Chairman.*) You represent the Bradford Dyers' Association, Limited, I believe?—I do.

Methylated spirit for dissolving aniline colours. Its cost the only objection.

3966. I understand that the Association themselves are not directly interested in the question before this Committee, that is to say, they do not themselves wish to make use of alcohol in their own Works?—No; to that extent we are not directly interested in it. We do use methylated spirit, and we have no objection to make to the use of methylated spirit.

3967. Where you use it, it is unobjectionable?—Yes. We do not like Finish, we use the spirit chiefly.

3968. What sort of processes do you use it for?—For dissolving aniline colours. We use spirit solutions of aniline colours, especially for delicate light shades. With colours in water solutions alone it is very difficult, in fact, to get the lightest shades of pink or blue perfectly even.

3969. Do you obtain the colours in a solid form as powders, or crystals?—As a rule, we buy them in the spirit solution, but of course they are expensive to use. All the aniline colours were used in that condition at first, until they brought out colours which were soluble in water later on. That was on account of the cost chiefly; and practically, with the exception of the very delicate shades, we are not able now to use the spirit solutions.

3970. Are these colours that you buy in an alcoholic solution manufactured in this country?—Yes, to a certain extent. I should say the bulk of them are manufactured here.

3971. Of course no colours manufactured abroad would arrive in this country in an alcoholic solution?—No. I should say that all of those which we use in an alcoholic solution are manufactured here. It is only a very small amount of them that we use, but we should use more of them and we should in that case dissolve them ourselves, if we could get the spirit cheaper.

3972. Then it is more the high price of the methylated spirit than the character of the methylated spirit that you object to?—Yes, it is entirely that.

3973. What do you put the difference between the cost of methylated spirit and the other spirit at?—I do not know that I have any definite opinion on that matter.

3974. Have you formed any estimate of what the saving would be in using pure alcohol, as compared with methylated spirit?—No, I have not.

3975. The total quantity that you use is not large, is it?—No.

3976. As a matter of fact, the difference between the pure spirit and the methylated spirit, in point of cost, may be taken at, roughly, something like 6d. per bulk gallon; that does not seem as if it would be a very important item?—I do not think it would be for us, really. I merely mention the fact as one item, in which we do use spirit.

Tannic acid. Non-manufacture in this country attributed to high price of alcohol as compared with Germany and Switzerland. (*See also* Qs. 4043-66).

3977. Then you refer to tannic acid; how is tannic acid used by dyers and printers?—Chiefly in the form of a flaky crystal and powder. It is not the purest tannic acid that we use, but it is a good commercial tannic acid testing roughly about 60 per cent. by Lowenthal's process.

3978. Has that to be prepared with alcohol?—I understand so; at any rate we buy it all from Germany and from Switzerland.

3979. Are you very much in the hands of the Continental manufacturers as regards price?—We are entirely in their hands in that respect.

3980. Is there not much competition amongst them?—Of course there is competition amongst them, but we have no alternative but to buy it from them.

3981. Is the condition of things at the present time such that you consider that you are paying rather an exorbitant price for tannic acid?—I do not know that it is exorbitant, and I cannot say that it is. At the same time I think probably if we had it made at home we could have it made cheaper, because the bulk of the raw materials from which it is made are imported from the British Colonies into either England or the ports on the Continent.

3982. Do you know what quantity of tannic acid is imported?—I have no idea what quantity is imported. I know that it is much more largely used by the calico printers, for instance, than it is by us. The use of tannic acid is gradually growing. In the old days we used to use sumac, myrabolams and dividivi and things of that kind; now we are mostly using extracts of them or tannic acid.

3983. (*Mr. Tyrer.*) Do you find that the extracts of these substances of vegetable origin act as well as the tannic acid?—No. We can only use them in dark shades.

3984. What do you do in regard to the delicate shades?—For the delicate shades we always use tannic acid.

3985. Are not the extracts to which you refer which are used for the darker shades made in Great Britain?—Yes.

3986. They are made in Scotland chiefly, are they not?—They are made in Scotland, Lancashire and Yorkshire. Of course, we have got extracts from France, but of late years the English people seem to have mastered the French competition in that respect.

3987. So that that competition from France has practically ceased?—It has.

3988. But that is not the case with those products in which alcohol is a necessity?—No. I am assuming that you are speaking of tannic acid.

3989. Is one correct in the impression that a comparatively small quantity of colours or colouring matters dissolved in alcohol is imported ?—Yes.

3990. Obviously that is because of the duty ?—Yes.

3991. The Chairman asked you, I think, about the price; has it ever occurred to you, in consequence of your strong conviction about tannic acid and the desirability of having cheap alcohol in order to manufacture tannic acid, that as a matter of business you might make some sort of calculation as to the price at which alcohol should be supplied to you in order to get equal results ?—It has not, and I have not calculated that. As I said at the first, we are only indirectly interested in this question, and it is only at the direct instigation of the Chamber of Commerce that we are actually represented here. Therefore I did not go into the details; I took it for granted that somebody else would do that who would be perhaps more directly interested in them than we are.

3992. (*Mr. Nicholson.*) It is rather a general statement that you make, "If we could have cheaper alcohol." Can you give us no idea how much cheaper you would require it in order to make tannic acid ?—From what I gather, alcohol is much cheaper on the Continent than it is here, and therefore, on that account, they are able to make tannic acid there, while our manufacturers are not able to do it here on account of the higher cost.

3993. That brings us back to the old statement, that it is State aided alcohol which they have abroad ?—That is exactly what I mean. I cannot give you the figures, because I have not gone into the matter. It is a growing trade, and in thinking the matter over after your letter came, I naturally looked to anything in which alcohol was used.

3994. You do not suggest that you should be put in the same position as those foreign countries which have State-aided alcohol, do you ?—I do not go as far as that. I merely say that they have cheaper alcohol than we have. That may be due to many causes of which I have no cognisance. At the same time, the fact remains that our people cannot make tannic acid and foreigners can. I do not know why that is, beyond a certain point.

Suggested reduction in proportion of wood naphtha used for denaturing.

3995. (*Mr. Tyrer.*) You say in your *precis* that the objections "from a dyer's point of view to the use of methylated spirit are not so important if wood naphtha, as at present, is used for methylating"; does that mean that not the mineralised methylated spirit which is bought in the shops, but the methylated spirit as used under licence, is suitable ?—Yes. As far as we are concerned we should have no difficulty with that.

3996. You could get along with it ?—We could get along with it.

3997. Then you add, "but the amount should be reduced to the smallest possible minimum"; what induces you to give us that opinion ?—I look upon it in this way—if it is an adulterant, the less used of it the better.

3998. As probably Dr. Thorpe will remind you, the object of adding wood naphtha is to make it impotable, and therefore, as you will understand, it is very important, considered from the revenue point of view, that impotability should be secured ?—I quite understand that.

3999. I am for the extended use of alcohol, of course; but the case for pure alcohol undenatured is not very fully made out, if alcohol with the addition of wood naphtha unmineralised suffices ?—That is so.

4000. There is another question, and I do not know whether it has ever occurred to you: supposing one of your rivals on the Continent, a dyer, was using some dye—I am not sufficiently acquainted with their names or their range to mention one, but one will readily occur to your mind—how much is he advantaged as compared with you in making his solution ? Presumably, with the same colour to produce the same results, you would have a solution containing the same amount of colour ?—Yes, presumably.

4001. So you would both stand in the same position as regards the colour. Then on the assumption that it is necessary to use alcohol, how much, in your opinion, are you disadvantaged by the present price of methylated spirit ?—I can hardly answer that question.

(*i.e.*, Q. 3991.)

4002. It is the same as the previous question, only put in another way ?—Yes, it is.

4003. (*Mr. Nicholson.*) Would you go so far as to put it at 6d. per gallon ?—I have made one or two inquiries and the information I have got differs somewhat, but as far as I can gather that price is even lower than what they get it at over there.

4004. If you could buy your alcohol 6d. per gallon cheaper, would the tannic acid trade and the colour trade come to this country ?—I cannot answer that. I should say that it would certainly help, but I do not know how far it would go, because we are not manufacturers of tannic acid, neither do we wish to make it. It is only, as I said, indirectly that the question arises with us.

4005. But it is an important question for this Committee? —Yes, I quite understand that; and if you wish it I will try to get some information on the matter.

Bradford goods formerly sent to France for dyeing. (*See* also Q. 4014.)

4006. (*Mr. Tyrer.*) I think it would be useful if a great representative Association of an industry like yours, which is known to have such keen rivalry on the Continent, could help us on this point. I think I am right in saying that certain classes of goods are sent over to the Continent to be dyed and then come back again, is that so ?—That has been done.

4007. It may not be to such a great extent now, though? —No.

4008. Still if that is in any degree the case it will be very important that this Association should know what it is doing, and as we have had witnesses making a note in the way of addendum to their evidence, subject of course to the approval of the Committee, it would be as well if you were to consult with some of your friends and try to ascertain what the relative advantage would be; that would be a most important piece of information and would help us a great deal ?—I will try to do that.

4009. (*Chairman.*) I rather understood that it was not an enormous quantity that was used in solution ?—Not with us, but I think you have had other evidence on that point. Alcohol enters largely into the production of either the intermediate products or the colours themselves.

4010. We are talking now merely about these solutions ? —I say that is not a large trade. Originally all aniline colours I believe were only soluble in alcohol.

4011. (*Mr. Tyrer.*) Do you happen to know—I will not say of your own knowledge, but have you ever heard that the tendency of discovery and of research has been to get rid, if possible, of alcohol in any form, even on the Continent ?—No, I cannot answer that of my own information.

4012. (*Sir W. H. Holland.*) I suppose your firm is one of the largest buyers of dyeing material in the country ?—Yes.

4013. I do not know whether it would be as large a user of colours as the Calico Printer's Association ?—Yes, it would be thereabouts I should think.

4014. I noticed you said just now, in reply to a Member of the Committee, that goods from Bradford had been sent abroad to be dyed and finished, but you seemed to lay stress on the "had been"; are we to understand from that that the practice has ceased ?—I might almost say that it has. That is to say it is only in certain cases and in these very delicate shades of colours where it has been the habit to send them to France, chiefly. But I think now that in our organization at any rate we have fully overcome that difficulty. I do not say it was due to the colour. It was perhaps due to the atmosphere, or perhaps it was due to our method of spinning; but whatever it may be, the fact remained that goods were sent from Bradford to be dyed and finished abroad.

Goods sent to France for dyeing. (*See* Qs. 4006 7.) The practice not necessarily attributable to alcohol question, and now practically abandoned.

4015. You are quite clear in your own mind that with cheaper alcohol you would be better able to meet foreign competition ?—I say that in these particular shades we should be better able to meet foreign competition.

4016. (*Mr. Nicholson*). Can you give us any idea what quantity of alcohol you would use if you were allowed to use duty-free alcohol ?—It is very difficult to say that. I could not tell you. It is such an unusual thing to look at it from that point of view. We have never dared to think of its being duty-free.

4017. When you ask to be allowed to use duty-free alcohol one ratner expects that you would have looked into it and would be able to give us some idea of the advantages that it would prove to you ?—The advantages are relative advantages, and once we were to use alcohol, or were to

Mr. T. Whitaker.

3 Jan 1905.

have it cheap enough to use it in that form, it would gradually grow. At present we go on doing the best we can with what we have, but if we had cheaper alcohol I am certain it would gradually grow in consumption, though to what amount I could not say.

4018. There is a limit of course to the power of this Committee to afford you relief ?—Just so.

4019. Cannot you give us some idea as to what relief would enable you to start work ?—I should only have to give you a guess, so to speak, if I did it now. I will look into the matter fully, and I will try to give you some definite idea.

Objections to use of water as solvent for dyeing delicate shades.

4020. (*Dr. Thorpe.*) You say that you use spirit in connection with these very delicate shades which you cannot use in connection with water; that is to say, they are not, I suppose, sulphonated dyes, and presumably for that reason you cannot use them in connection with water ?—No; they are mostly basic colouring matters.

4021. You cannot use them in connection with water, mainly because of the varying quality of the water, is what you say in your *precis* ?—I am speaking generally there of our own water at our own works. We may have getting on for thirty branches, and the water in each of those branches is not the same as it is in the others. Some of it is very hard, and some of it may be very soft.

4022. What you say in your *precis* is that it is " chiefly owing to the variation in the quality of the water used by different dyers, namely, as to hardness or as to metallic salts in the water, causing precipitation of the colour in the form of stains on the cloth and spoiling the effect ? " —That is the case.

4023. Therefore you are only able to dye those colours when you are in a position to use them in a fairly strong solution so as to equalise this effect upon the cloth ?—It does not exactly depend on the strength of the solution. It is not a strong solution, even in alcohol, that we should use to dye those with ; it is the equalising effect of the alcohol in the dye-bath that I refer to.

4024. When you use an aqueous solution of the dye, the inequality is mainly due to the association of salts and other matters dissolved in the water which are precipitated on the fabric ; is that so ?—Yes, that is so.

Suggestion that distilled water would meet the case, and be cheaper than alcohol. (*See* also Qs. 4067-79.)

4025. If that be the case, why cannot you use those soluble water dyes in association with distilled water ?—We could not afford to use distilled water.

4026. Distilled water is a good deal cheaper than alcohol, is it not ?—I do not think we should ever dream of using distilled water as such.

4027. The dyer is a man who has the means of evolving large quantities of steam from his boilers ?—Yes.

4028. A very elementary plant would capture a great deal of steam and turn it into distilled water, would it not ?—It would not.

4029. Supposing he used distilled water—could he not do that ?—It depends there again ; if he began with distilled water in the boilers, yes ; but not in his dye bath.

4030. You cannot make use of the steam from the dye bath, of course, and I am not speaking of the dye bath ?—You know the West Riding as well as I do, and you know what a dye house is, and you know how pressed they are at certain times.

4031. That is another matter ; that is a matter of organisation, is it not ?—I am putting it in another way. The boilers are pressed, there is the work wanting doing, the boiler primes, they are not using distilled water, but whatever water they have, lime salts come over, and as most of the baths are boiled with direct steam, lime salts get into the water.

4032. It is not a very difficult operation to make such a character of distilled water as would practically eliminate any effect of these lime salts or magnesia or other metallic salts which may be present in the water, is it ?—I think you rather underestimate the amount of stains that occur in a dye house, especially on dark days like this.

4033. How does a dark day introduce lime salts and magnesia salts ?—It is not altogether the lime salts.

4034. I am confining myself for the moment to the matters to which you ascribe the cause of the unfortunate effects upon the fabric. I point out to you that if these effects are due to the lime salts and the magnesia salts in the water of varying quality and varying degrees of hardness, as you allege, surely a cheaper way of getting rid of those effects is to distil the water rather than to use spirit ?—You also get tarry matters sometimes from the colours which in a water solution alone are sometimes thrown out ; but with the spirit solution they still remain dissolved.

4035. When you are dealing with these delicate dyes you are dealing with something in the nature of a definite chemical combination, are you not ?—Of course you get them as pure as you can commercially.

4036. There is no tar, as such, left in them ; they must be extremely crude dyes if they are of that character ?—I spoke of tar because that is what we term it ; but there are stains, at any rate, composed of the precipitated colour or something else of a bronzy nature.

4037. These matters are not in the dye if you take the pure colouring matter—in other words, if you get it into a form in which you can dissolve it in water ?—They are not used in a sulphonated condition.

4038. If they are basic they may be soluble in water, may they not ?—Yes, that is so.

4039. All you complain of is that you cannot use them in water, because the water, you say, is impregnated with various lime, magnesia, and other salts, which have the effect of staining the fabric ?—Yes, for certain shades.

4040. My suggestion to you is that a good deal of this inconvenience might be obviated if the water were purer. I do not know that the rain water of Bradford would be sufficiently pure for your purpose—probably not ; but anyhow you could make a much purer water than you do with a little skill, and at a very much cheaper rate than using pure spirit ?—Of course.

4041. I am quite aware that this has never occurred to a dyer. I have never heard of a dyer yet who thought of using distilled water, but why he should not is what I should like to know. Why should he go and apply alcohol, which is at least three or four times the price ?—We do use the purest water we can get for the light shades naturally. The point is that we never distil the water purposely for it.

4042. I think in many instances, especially for the relatively small quantities of these materials you are using—because you admit that they are not used on a very large scale—that you might get over the difficulty by using a specially purified water, and that you can do that at a much cheaper rate than going to alcohol ?—That is one of those things that I should not like to say we could do.

Tannic acid (*See ante* Q. 3977-94).

4043. Now I come to the tannic acid ; what natural advantages has Switzerland in the manufacture of tannic acid ? Other than the relative price of alcohol, has she any ?—I do not think so.

Reasons for non-manufacture in this country discussed

4044. Of course the alcohol which is used in the manufacture of tannic acid is for the most part recovered and used over and over again ?—Yes.

4045. The alcohol is only used in the extraction ?—Yes.

4046. So that all that the English manufacturer suffers from is the fact that he has perhaps to pay a rather higher first cost upon the spirit than his Swiss competitor may have to do ; is that your point ?—Yes, I should think that is so.

4047. Do you know, as a matter of fact, that your Swiss competitor does make use of pure alcohol ?—I do not know.

4048. Would you be surprised to learn that, as a matter of fact, he uses a denatured alcohol ?—Yes.

4049. And an alcohol much more heavily denatured than his English competitor would have to use ? Would that be news to you ?—Yes, it would.

4050. That is a fact ?—Is it more expensive than here ?

4051. About the relative expense I am not now in a position to say, but the fact is that he uses, not pure alcohol at all, but a denatured alcohol. Do you think that tannic acid is not made in this country ?—The very purest forms of it may be made, but commercially I know of only

one firm which does make it, and they turn out rather a crude product. I know of no other firm who have offered tannic acid as being made by themselves here.

4052. Assuming that they can make it, as, in fact, they can, with methylated spirit, inasmuch as the alcohol, as I say, is used over and over again, what is the particular reason why tannic acid cannot be produced in this country at something like a price that you can purchase it at ?—That I do not know. I only know that the fact remains that all our tannic acid comes from abroad.

4053. There must be some particular reason other than the price of alcohol for that ?—I think the alcohol is the chief reason ; I have always gathered such.

4054. Take the tannic acid which is made in Switzerland, what is the natural substance from which it is derived ?—I should think either nut galls or something of that kind ; probably in the cheaper forms myrabolams.

4055. Those would have to be imported into Switzerland ?—Exactly so.

4056. Surely to bring myrabolams into Switzerland is a more serious matter than to bring myrabolams into this country ?—That is why I say I do not understand why it has not been made here, excepting that it is due to the excessive cost of extracting the tannic acid.

4057. Is the oak more prevalent in Switzerland than in this country ?—I do not know, I am sure.

4058. You do not absolutely know what is the raw material from which the Swiss manufacturer makes it ?—I am speaking more of Germany than Switzerland.

4059. What does the German make it from ?—Cheifly from nut galls, I believe—Chinese galls.

4060. Imported galls ?—Exactly.

4061. Of course we can get imported galls just as easily as the Germans ?—We use them ourselves in the ground form, and we use myrabolams in the ground form, in the water extraction process ; but we can use none of these for the most delicate shades.

4062. Do you make any of your intermediate dye products ?—No.

4063. Has it ever occurred to you to prepare any of the mordants and other things that you want ?—The mordants, yes.

4064. Tannic acid, for example ?—No.

4065. Why not ? Why should not an Association like yours prepare some of these products which you need ? —Generally we have always something better to do with the money for other purposes.

4066. It would not pay you to make it ?—I do not think so.

Distilled water. (*See* ante Qs. 4025–42).

4067. (*Mr. Tyrer.*) In regard to the distilled water, which is a very practical question, the only thing I did not quite understand was the abundance of steam. I think what Dr. Thorpe had in his mind was that you use as a rule live steam ?—Yes.

4068. It would be difficult, of course, to condense the steam and shut off your vats when you want to see what is going on ?—Yes.

4069. (*Dr. Thorpe.*) Are you not aware that a large quantity of the water that is used now on the ships in the Navy and merchant service is distilled, and in many cases collected from the exhaust steam from the boilers ?—We collect all the waste steam, where it is possible, from the exhaust, from the engines, and things of that kind.

4070. Putting it back into the boilers ?—Yes, and it is used in the vats or wherever it can be.

4071. You can use that steam ?—We are using the bulk of all our distilled water, or condensed water as we should term it, for scouring purposes.

4072. And you say you can use it for dissolving purposes? —We should do so as far as we could, but it might not be in an exactly easy position for getting it there.

4073. (*Mr. Nicholson.*) Cannot distilled water be very cheaply bought in bulk ?—Do you know what quantity of water we use per annum ? One works will use eight to ten million gallons per week.

4074. Not for this purpose ?—No, for all dyeing purposes.

4075. (*Dr. Thorpe.*) But we are speaking of this particular purpose ?—Just so, but we should not pretend to buy it for that.

Loss of spirit in dyeing.

4076. (*Mr. Tyrer.*) You say that these delicate shades get injured by using water with lime salts in it, and for these delicate shades it is necessary to have the alcohol, which is wasted as I understand ?—Yes.

4077. Would it not be possible to have an apparatus into which a considerable quantity of the textiles to be dyed with these delicate shades could be put, which should have a cover which could be automatically fitted and so on, so that you could in that way recover the spirit ?—No.

4078. You do not think that would be possible ?—I do not think it would.

4079. Not with mechanical appliances inside, just as you have in a vacuum apparatus ?—I do not think so. It would have to be in sight. The man must see the thing going on all the time, and it must be kept constantly moving. They are not in a rope form ; they must be done all the width and so on.

Solution of nitro-cellulose varnish for mercerised goods. Acetic ether the best solvent, but too costly.

4080. (*Chairman.*) I think you desire to bring to our notice the subject of a varnish about which you have written to Dr. Thorpe ?—Yes.

4081. In your letter to Dr. Thorpe you mention that your Association has actually taken out a patent for the application of a varnish made with nitro-cellulose dissolved in amyl acetate, amyl formate or acetic ether, and that the amyl acetate and amyl formate are not suitable, because of the smell ?—That is so.

4082. So that you are driven back upon acetic ether ?—Quite so.

4083. The duty is 1s. 11d. per lb. upon the amount of acetic ether present in the varnish when you import it ? —Yes.

4084. That, you say, makes it not commercially profitable ?—That is so.

4085. As I understand, you have acquired the patent —not for making the varnish, but for applying it ?—Yes, for applying this varnish to the goods.

4086. Is the varnish itself the subject of a patent ?— No, it is only the application of that particular varnish to cloth that is the subject of a patent.

4087. Could you manufacture that varnish ?—Yes I take it so, certainly. I do not think there is any patent for dissolving nitro-cellulose in amyl acetate or amyl formate. It is only the application of the mixture that is patented.

4088. (*Mr. Tyrer.*) In other words, you are using collodion ?—Exactly, only the smell with amyl acetate is so strong that we cannot get rid of it. Amyl formate is better, but acetic ether is better still, only we are met then with the difficulty as to cost.

4089. Is acetic ether made in this country ?—What we have had we have bought from abroad.

4090. Then you have bought the varnish completely made ?—Quite so.

4091. The nitro-cellulose being already dissolved ?— Exactly.

4092. Supposing you wanted to dissolve the nitro-cellulose yourself and to make the varnish, what would you get acetic ether for in this country ?—I think for small quantities they ask 3s. 1d. per lb. and about 2s. 7d. for larger quantities.

4093. You are right as to the first figure, but the other cannot be so low as that ; they could not possibly do it for 2s. 7d. ?—We should not make it ourselves. We want to purchase this solvent and to use it with our nitro-cellulose, but we do not want to purchase it abroad. At the present price we are debarred from purchasing it from anywhere, as it is too dear to import it even.

4094. (*Dr. Thorpe.*) Have you made experiments yourself with these various solvents ?—We have made them in the laboratory.

Methyl acetate suggested as substitute for acetic ether.

4095. Have you tried acetate of methyl ?—I do not know that we have.

4096. That would be as good a solvent probably as the acetate of amyl, and would certainly be more volatile? —Is it comparatively cheaper ?

Mr. T. Whitaker.

3 Jan. 1904.

4097. You would have to pay 2s. 9d. per gallon for your raw material, the wood naphtha?—Thank you for the suggestion.

4098. (*Chairman.*) Is this a specimen of the stuff you want to make? (*Handing specimen to Witness.*)—Yes.

4099. (*Mr. Scott-Montagu.*) Is that coated on one side?—Yes.

4100. It looks like silk?—Yes.

4101. (*Chairman.*) It is for the purposes of clothing?—Yes.

4102. (*Mr. Scott-Montagu.*) That is practically an imitation silk or imitation satin, is it not?—Exactly, if you like to term it so.

4103. It is a sort of satin?—It is originally a cotton which has been mercerised, and then after that this varnish is put on. The mercerising process gives a lustre to the cotton. We cannot, of course, convert it into silk; we wish we could.

4104. (*Sir William Crookes.*) Is there much nitrocellulose left on this specimen?—There is some.

4105. Is there sufficient to make it inflammable?—I do not think so.

4106. (*Chairman.*) I suppose a gallon of the varnish would go a long way and do a lot of work?—Yes.

4107. But even then the price is too much?—It is too dear for us. In a sense it is difficult to get any more money for the product because it is practically building up a new trade.

4108. (*Mr. Tyrer*). Which is not now done by Germany?—Which is not now done by anyone. We have taken out protection in Germany too.

4109. (*Mr. Scott-Montagu.*) Supposing wood silk came into much use would that affect this process in any way?—No, it would not affect that process at all. The wood silk process is a viscose process practically. Viscose will not do.

4110. (*Sir W. H. Holland.*) Did I understand you to say that you have taken out a patent in Germany?—A protection.

4111. They will not grant you a patent unless you work it there, will they?—I think we can license someone to do it; we have already had applications for that.

4112. (*Mr. Tyrer.*) And you fear that if you grant those licences, unless you can make these goods on equal terms they will become your rivals?—Unless we are put on equal terms.

Mr. THOMAS MACWALTER, called; and Examined.

Mr. T. Macwalter.

3 Jan. 1904.

4113. (*Chairman.*) I understand you represent Messrs. Elliott & Son, Limited, of Barnet?—Yes.

4114. What is their business?—They are photographic plate and paper manufacturers.

4115. Their interest, I suppose, in this question of the use of spirit is in connection with collodion?—Yes, chiefly.

Collodion for photographic printing papers.

4116. What collodion do you use now?—As a matter of fact we have not yet got our product on the market, but we hope to put it on in a very short time. The collodion that we are making is for photographic printing papers.

4117. Is the collodion that you are going to use for that made in this country?—It is made by us.

4118. What spirit do you use for that? Is it the ordinary methylated spirit?—At the present moment we are using the ordinary methylated spirit.

Disadvantages of methylated spirit whether ordinary or mineralised. (*See* also Qs. 4182-90.)

4119. Do you find that unsatisfactory in any way?—Yes, for several reasons. We find that the number of defects that we get in the paper with methylated spirit are very considerable and that they are not present with the pure alcohol.

4120. Where are you getting your methylated spirit?—From Sutton, Carden & Co.

4121. To what do you attribute those particular defects?—I think simply to the presence of the mineral naphtha.

4122. You are not using mineral naphtha, are you?—Yes.

4123. Have you not tried it without mineral naphtha? There is another kind of methylated spirit which you could use if authorised which has not got mineral naphtha in it?—Yes, we know that as manufacturers' spirit. We have tried that.

4124. Does that produce the same bad effects?—Not quite the same defects, but it has defects of its own that we do not get when we are using pure spirit.

4125. Are you now speaking of collodion papers?—Yes.

4126. (*Sir William Crookes.*) Are they printing papers or for negatives?—They are printing papers.

Expense of Excise Supervision under Finance Act, 1902, would be fully compensated by advantages of pure alcohol duty-free.

4127. (*Chairman.*) You wish to be allowed to use pure spirit; what sort of safeguards could you provide if you were allowed to use pure spirit?—I hardly know.

4128. You would have to submit to rather strict supervision, naturally?—Yes. The only safeguards that we could adopt would be to keep the alcohol under lock and key with the keys in the hands of responsible authorities.

4129. For that, a considerable attendance of Excise officers would be necessary?—Yes; that would not be any disadvantage.

4130. But for that you would have to pay. Are you satisfied that the ordinary unmineralised spirit has disadvantages of such a kind that it would be worth your while to pay much to get rid of them?—Yes, we would willingly pay double what we have to pay for the methylated spirit to get rid of it.

4131. You would pay double the price of your spirits?—Yes, willingly.

Dry plates; methylated spirit suitable if of sufficient strength.

4132. Is it equally important in the manufacture of dry plates?—No. There is only one disadvantage in using methylated spirit in the manufacture of dry plates, and that is the difficulty of getting methylated spirits sufficiently strong.

4133. Is what you get about 64 over proof?—Yes.

4134. Would you like it still stronger?—Yes, we should like it of a specific gravity of about ·807. There is a decided advantage in the manufacture of plates as we manufacture them, in using it of a strength of ·807.

4135. (*Mr. Nicholson.*) Can you tell me what degrees over proof a specific gravity of ·807 corresponds to?—No, I cannot.

4136. Nor what percentage of alcohol?—I think it is a percentage of somewhere about 93.

4137. It must be more than that, because 93 per cent. corresponds to 63 over proof?—Then I could not say definitely.

4138. (*Mr. Tyrer.*) ·807 is getting appreciably near to absolute alcohol?—Yes.

4139. (*Dr. Thorpe.*) You can get 97 per cent. alcohol now?—I have a letter with me in which Sutton, Carden & Co. say it is impossible to supply it of a specific gravity of ·807.

4140. I can show you a letter stating that you can get any quantity of 97 per cent. alcohol made in England; and I venture to say that that is quite strong enough for you?—We are, as I say, buying from Sutton, Carden & Co., and I have a letter with me dated only last week in which they say it is impossible under the Excise regulations to supply it of a specific gravity of ·807.

Ether a possible denaturant in making collodion. (*See* also Qs. 4171-3.)

4141. (*Chairman.*) You say at the end of you *precis* that in the manufacture of collodion papers, ether might be added in place of spirit, but it is not advisable to do so; why is that?—We find in manufacturing collodion that it is better to allow the pyroxyline to remain with the alcohol for a matter of twenty-four hours—we get a better collodion by doing that—and then adding the ether; but there is no serious disadvantage in adding 10 per cent. of the ether.

4142. (*Mr. Tyrer.*) In other words, denaturing the alcohol by the addition of ether?—Yes.

4143. (*Sir William Crookes.*) You must use ether before the pyroxyline will dissolve ?—Yes.

4144. (*Mr. Tyrer.*) Only it is a soaking process ?—Yes.

4145. (*Chairman.*) You dissolve the pyroxyline in a mixture of alcohol and ether ?—Yes.

4146. In which there is how much per cent. of ether ?—About 37 per cent. to 40 per cent. of ether.

4147. (*Dr. Thorpe.*) Then that is a very low nitrated cotton ?—Yes.

4148. (*Sir William Crookes.*) Can you give any idea of the quantity of alcohol you would be likely to use ?—That is a very difficult question, but we hope to be able to use something like 20 gallons per day, or 100 gallons per week.

German printing papers. English competition prevented by cost of pure alcohol.

4149. Is it a development paper that you propose to make ?—No, it is a printing-out paper. It is really to compete with the papers that are so common on our market, supplied by Germany.

4150. (*Mr. Tyrer.*) In which collodion is used ?—Yes.

4151. In the same way, so far as you know ?—Yes.

4152. (*Mr. Nicholson.*) Do they compete with you a good deal ?—They do not compete with us; it is we who want to compete with them.

4153. The market does not exist with you at present, then ?—Not for the moment.

4154. (*Dr. Thorpe.*) Although there is an importation of collodion papers from Germany into this country ?—Yes, and a very big importation, too.

4155. Your point is that English makers have not been able to compete with the Germans on the ground of the high price of alcohol ?—Yes.

4156. And the fact that they must use a relatively pure alcohol ?—Yes.

4157. (*Mr. Tyrer.*) How much collodion do you use for a given area of paper; supposing that you had 20 gallons of collodion, how much paper would that do ?—Roughly speaking, it would be about a gallon and a half to 500 square feet.

(*See* Q. 4130-1.) Pure spirit even at double present price of methylated spirit would make competition possible.

4158. (*Mr. Nicholson*). You said just now that you would not mind the cost of the methylated spirit being doubled to you ?—No, but of course we do not want that.

4159. That would not prevent your competing ?—No.

4160. But the present price of alcohol would ?—Yes.

4161. Therefore, roughly speaking, the difference between 6s. and 12s. would make the difference between competing and not competing ?—Yes.

4162. (*Sir William Crookes.*) Perhaps the Germans have put on an extra profit, and they would come down in price if you entered into competition with them ?—Possibly.

4163. (*Dr. Thorpe.*) Do you know what the price of collodion paper in Germany is ?—I do not know exactly, but for a cabinet photograph I think it is a shilling for twelve pieces.

4164. And what is it here ?—Here the German paper is about the same price.

4165. In other words, it is put down here at the same price as it is sold in Germany ?—Yes.

4166. Is it subject to competition there ? I suppose a number of people make it ?—Very few: I do not think that there are more makers than five in the whole of Germany.

4167. Do you know whether there is any combination among them as regards the price at which it is sold ?—I think not.

4168. Then the price at which it is sold in Germany represents what you may call its natural price ?—Yes.

4169. (*Mr. Tyrer.*) At present you cannot meet that price ?—No.

4170. (*Dr. Thorpe.*) But you could at double the present cost of methylated spirit ?—Yes.

Ether as a denaturant. (*See ante* Qs. 4141-7.)

4171. (*Mr. Tyrer.*) Even then it would have to be rendered impotable, or the collodion would have to be rendered impotable. Has it occurred to you whether there is any substance that would render the spirit or the ether or the collodion as a whole extremely noxious for drinking purposes and yet would not interfere in the slightest degree with your work ?—The only thing that I can think of is to put ether into the alcohol. I do not know any man who would drink it then.

4172. Unfortunately facts are against us in that matter. Of course there would come in the question which the Chairman put to you very early about supervision ?—Yes, of course.

4173. (*Dr. Thorpe.*) Besides, if that alcohol containing ether happened to get out of your custody, it would be very easy to get rid of the ether in it, would it not ?—Yes.

4174. (*Mr. Tyrer.*) The question of supervision is very largely a question of expense, and the reduction of expense relatively is a question of the size of the manufacture ?—Yes.

4175. In that connection may I ask whether there are other photographic paper makers who would use a similar process to your own ?—There is one in the country making very large quantities of paper.

4176. And using collodion ?—Yes.

4177-8. Do they make probably as much as you ?—They are actually manufacturing, and have a large business; we at the present moment have no article on the market.

4179. (*Mr. Tyrer.*) Do the firm you refer to find the same difficulty with regard to cost as yourselves ?—I cannot say what transpires with them at all. I do not know what they are using.

4180. From that it may be inferred rightly, I think, that they are content ?—I know that they are not content with the profits that they are making; they are having very serious difficulty in meeting the German competition in collodion papers.

4181. Have they had any conference with you on this matter ?—No.

Objections to methylated spirit. (*See ante* Qs. 4119-24).

4182. (*Sir William Crookes.*) You say that there are certain defects which you meet with when using ordinary methylated spirit; do you know whether those defects are noticeable on other finished papers ?—On the English-made papers, yes, it is.

4183. Then from that you can infer that they are using methylated spirit ?—Yes.

4184. (*Mr. Tyrer.*) In other words, you can tell whether methylated spirit has been used or not, on looking at the paper ?—We have never thought of that question at all. We simply find certain defects, which we invariably get when we are making collodion paper with methylated spirit.

4185. Both with the mineralised and with the unmineralised; that is to say, the manufacturer's spirit, as you call it ?—Yes.

4186. With both of them you find distinct defects ?—In our manufacture with both there is a distinct defect, and in the paper that is already on the English market we find the defects present which we get when we use manufacturer's spirit.

4187. (*Dr. Thorpe.*) Why should a collodion maker use mineralised methylated spirit ? Surely he cannot know his business if he goes for mineralised methylated spirit ? Why should he use it at any time ?—I do not know why he should.

4188. Does he ever use what has been called "finish"?—I should say not.

4189. But it is quite possible he might ?—It is possible.

4190. On account of his ignorance of what methylated spirit may be ?—I am speaking altogether without knowledge as to what a manufacturer of collodion would use, but it is quite possible he would use finish, though why he should use it I do not know.

4191. (*Chairman*). Are the German papers made free from the defects which you have mentioned ?—Quite.

The German denaturants for making collodion.

4192. Do you know how they are manufactured ?—No

4193. You do not know for certain that in them perfectly pure spirit is used ?—I do not know for certain at all. I only know that the German papers are free from the defects that we get in ours, and that we can get free from those same defects by using pure alcohol.

4194. As a matter of fact the Germans have to use some process of denaturing, and therefore if their papers are free

Mr. T. Macwalter.

3 Jan. 1905.

from defects, their particular process of denaturing—by the addition of sulphuric ether, or benzol, or turpentine or animal oil—could be adopted here probably ?—Yes.

4195. (*Mr. Tyrer.*) I take it that animal oil is out of the question with you ?—Yes.

4196. Would benzol be out of the question ?—I am not sure that it would be. I have never tried the addition of benzol for collodion.

4197. Would turpentine be out of the question ?—It would be.

4198. Absolutely ?—Yes.

4199. Even rectified turpentine ?—Yes.

4200. Even carefully rectified ?—Yes.

4201. The benzol you are not, apparently, sure about ?—I am not sure about it. I think it is very likely that benzol might be used.

4202. Would it not be possible, before you have a proof of your evidence, to try ?—Yes.

4203. And if the result be such as to enable you to give an opinion, to do so ?—Yes.

THIRTEENTH DAY.

Tuesday, 10th January, 1905.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair*).

Professor Sir WILLIAM CROOKES, F.R.S.
Mr. LOTHIAN D. NICHOLSON.
Dr. W. SOMERVILLE.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*).

Mr. B. Biggs.

10 Jan. 1905.

Mr. BENJAMIN BIGGS, called; and Examined.

Wood naphtha for methylation.

4204. (*Chairman.*) I understand you are interested in the supply of the wood naphtha which is used for methylating ?—I am.

4205. Do you yourself manufacture wood naphtha ?—I am not manufacturing it just now. I have a works for its manufacture, but it is idle just now

4206. Why is that ?—Because trade is rather bad, and also in order to make certain improvements in the manufacture.

4207. Are you still supplying wood naphtha to the trade, though you are not actually manufacturing it ?—Yes.

4208. Do you purchase it ?—I have always been a dealer in it for the last fifty years.

Sources of supply: produced from home-grown wood, or imported. (*See* also Qs. 4365-80.)

4209. When you are manufacturing it where do you get your material, that is to say, the wood from which you manufacture it ?—Anywhere in the country where there is wood. Formerly the bulk of the trade was carried on in South Wales, because a large quantity of wood was wanted there for charcoal for the tinplate trade. Now steel has come in, and charcoal is no longer wanted there. Of course wood is a diminishing quantity, and there is no great quantity to be had in this country.

4210. Have you ever imported wood ?—No.

4211. Have you always used British-grown wood ?—Yes, for my trade.

4212. Can you without difficulty make enough wood naphtha for your purpose out of British-grown wood ?—The quantity of wood that could be obtained in England is not sufficient to make all the naphtha that is required We want for methylating purposes 360,000 gallons of naphtha per annum, and about 140,000 gallons only are made in this country, the rest being imported.

4213. Are there many other manufacturers of wood naphtha besides yourself ?—Yes, there are about twenty, I should think.

4214. You have been engaged for a long time in this trade, I suppose ?—All my life—over fifty years.

Introduction of methylated spirit in 1856.

4215. Then you remember the beginning of the methylated spirit trade ?—Yes, perfectly well.

4216. That was in 1856, was it not ?—It was about that time.

Wood naphtha at first supplied to methylators through Government.

4217. At that time, in the first instance, you had to supply the wood naphtha to the Government, I believe ?—Yes. We made a contract with the Government. I called the manufacturers together, and we agreed upon the price at which we should supply it, and then I made the contract with the Government.

4218. How long did that system last of the Government themselves providing the wood naphtha that was used for methylating ?—I should think about fifteen years.

4219. Do you remember why it was changed ?—The Scottish makers of methylated spirit complained that they had to pay the carriage on the naphtha from Tower Hill to Scotland. Then permission was granted for them to procure their own supply, but it still practically all came through my hands at that time; indeed I was prosecuted at the Old Bailey for keeping a stock for the Government which they could not take from me.

4220. How was that ?—My neighbours complained of the smell. The officers came down; they said they could not complain of the smell, but they could complain of the danger, and I had no right to keep that quantity of spirit in the crowded city. So I was prosecuted, but I was never punished

Afterwards to methylators direct

4221. Just after that, the trade in wood naphtha became free, did it not, and was no longer carried on through the agency of the Government ?—That is so; it became quite free.

4222. Do you think that change was an advantage ?—I do not think it made much difference. It did not make much difference to me, at any rate, because practically it all came through my hands at that time. There was not then the competition that we have had during the last ten or fifteen years. Now, there are so many Germans coming into the market, and I cannot say that I can control it any longer.

Wood naphtha can be profitably made in this country, and sold at same price as the imported. (*See* also Qs. 4279-83.)

4223. I suppose you have to sell your wood naphtha at the same price as that which is imported ?—Yes, it is about the same price.

4224. Can you make wood naphtha in this country sufficiently cheaply to enable you to make a profit at that price ?—Yes. The owner of the wood which is used gets practically nothing for it—a shilling per ton perhaps. In this country they cut down the wood for the purpose of timber wood, and then anything that would do for colliery purposes is used for those, and it is only the waste wood that the chemical people get; but in America they cut down a whole forest and use the large wood. The great cost in connection with the wood is in putting it nto the ovens.

4225. Then you really get your raw material for very

little ?—We get it for practically nothing, as far as the grower is concerned.

4226. What quantity of wood naphtha is your plant capable of making in the year ?—At my own works we can make about 4,000 gallons of naphtha per annum. It is only a small works.

Other products of wood, the selling price of which to some extent affects that of wood naphtha. (*See* also Qs. 4245-8.)

4227. You say in your *precis* that there are three products from the wood that you use, namely, acetic acid, charcoal, and naphtha ?—Yes, those are the three large products.

4228. Are the quantities of acetic acid and charcoal produced substantial ?—Yes; they are roughly about a third of the value. The price of charcoal does not vary a great deal, that is, it does not go above a certain point; because a man can take the wood in the woods, and what they call "coal" it in the woods; that is, make it into charcoal in the woods, and then he will have only a quarter of the weight to carry out.

4229. I do not quite follow one sentence in your *precis*; you say that the "cost of either of the three products cannot be fixed till the other two are sold." What do you mean by that ?—That seems to me evident. We have the common cost, we will say, amounting to five; then we have the three products; till we know what two are sold for, the price of the other cannot be fixed. The prices of these products vary from time to time, and recently acetic acid has gone up very much in price, nearly 50 per cent.

4230. Still I take it that what you want to do with your products is to get as much as you can for the three combined, is it not ?—That is so, certainly.

4231. The mere fact that acetic acid has gone up would not induce you to sell the charcoal or the naphtha cheaper, unless you could help it ?—Certainly not.

Quality of wood naphtha used for methylation. (*See* also Qs. 4311-30.)

4232. At the present time our system of methylation requires that there should be 10 per cent. of wood naphtha mixed with 90 per cent. of alcohol; the wood naphtha that you supply for the purpose of methylating, although it is not purified so as to be potable, is a fairly pure product, is it not ?—It depends upon what anyone calls pure.

4233. It is colourless ?—Yes.

4234. What is its strength ?—62 or 63 over proof when it is finally completed. In America and in Germany they make an absolutely pure methyl. In Germany it is used for colour making; here our colour makers are not allowed to use it, and the consequence is that Germany has absorbed the bulk of the trade in colour-making, because the Germans have access to this wood spirit which we are not allowed to make.

Pure methyl alcohol could be produced here if required.

4235. You are not prohibited at the present time from making pure wood spirit, are you ?—Yes.

4236. Are you actually prohibited, do you say ?—Yes, unless we like to pay 11s. per proof gallon.

4237. If you choose to do that, you can make it. If anybody wanted pure methyl alcohol, could you supply it ?—Practically it cannot be got in this country.

4238. But you could make it for them on order, could you not ?—Yes.

4239. Although you do not, as a matter of fact, make any ?—That is so.

4240. Is not the wood naphtha which is sold for the purpose of methylating sufficiently pure for use in the colour industry ?—No.

4241. Do you know that to be the case ?—Yes, that is the case. Mr. Tyrer would be able to give you evidence on that.

Excise regulations as to sale of methylated spirit. Their effect on the trade. (*See* also Qs. 4302-10.)

4242. Then you say that the trade is somewhat hampered by the Regulations of the Board of Inland Revenue; what are the particular regulations that you refer to ?—When we have mixed the methylated spirit, we are not allowed to sell it to anyone unless he brings a license. He must have a book of forms, and he must send me a printed form supplied by the Inland Revenue before I can deliver. Then the retailer has to pay 10s. 6d. duty per annum. A great many men who would sell a little do not like to pay the 10s. 6d. to begin with. What I feel is, that if anyone wanted to get methylated spirit without the control of the Government all he has got to do is to pay £20 a year for a little shop, and say he wants it for making a polish, and then the Government will grant it to him, and he can send it off to the public house next door if he likes—or rather, supposing he was not caught.

4243. Do you really find that those regulations seriously interfere with your business ?—There are a great many people who do not like to come under restrictions of any kind. I believe there would be a great deal more sold if, directly the naphtha is added to it, it were allowed to go free into the country just as the people liked. I do not think the present regulation is any protection to the Revenue. I do not think any one would for a moment think of purifying methylated spirit for drinking purposes, because it would be cheaper for him to make it from sugar or grain direct.

Difficulty and expense of purifying methylated spirit.

4244. Do you think that the cost of purifying and extracting the denaturant would be more than the cost of distilling ?—Undoubtedly. They would want to have an expensive plant. At one time I had to use methylated spirit to make shellac; that is, to dissolve the gum from what is called stick-lac and make shellac. After distilling over ten or twenty or thirty times, I really could not detect any difference in the methylated spirit; it was not sweet at all. I think I remember coming up to Somerset House and talking to—I forget who it was—at the time. Mr. Adam Young, I think it was.

Selling price of wood naphtha. (*See* also Qs. 4227-31.)

4245. What is, roughly, the market price of wood naphtha, as sold for methylating purposes now ?—About 3s. per gallon.

4246. That is a good deal lower than it has been in the past ?—Yes. Our first contract with the Government was at 8s. 6d., if I remember rightly.

4247. What has caused that great cheapening ?—Simply they wanted a new product, and at that time what we call naphtha, that is, wood spirit, fetched a higher price. We were getting for the ordinary wood naphtha then perhaps 6s. per gallon, and then we made the contract at 8s. 6d., because we had to go to a further purification in order to bring it up to the standard that the Government required.

4248. Was the cost of manufacture then much higher than it is now ?—The cost of manufacture depends upon what the other articles fetch; for instance, I have known acetate of lime to be as low as £5 per ton, and it is now £12 per ton.

Present cost of methylation estimated at 2d. per gallon for materials only.

4249. Are we to take it that with wood naphtha at about 3s. per gallon, you consider that about 2d. per liquid gallon is added to the cost of the methylated spirit ?—Yes.

4250. That is, an addition of 2d. in the cost of the materials quite apart from the cost of the mixing and the handling ?—Yes; it is for the materials only.

4251. The increased cost of the methylated spirit as compared with the pure spirit which is used for methylating would be a great deal more than 2d., would it not ?—No, it would be just about 2d. The spirit at the present time, if I am paying 10d. per gallon for 60 over proof, would be 1s. 4d., but we have to mix it at sixty-five or sixty-six over proof, and that would be 1s. 4½d. 1s. 4½d. from 3s. is 1s. 7½d., or, say 20d., and that 20d. buys over ten gallons.

4252. Do you yourself do any methylating ?—Yes.

4253. Then you are a methylator as well as a manufacturer of wood naphtha ?—Yes. I am the only remainder of those who were in it at the beginning; I have seen them all out.

4254. You observe in your *precis* that many persons are under the impression that if the English spirit is costing 10d. per proof gallon, the German spirit could be had at 5d. if it were not for the surtax ?—Yes, and two years ago it could have been had at 5d.

4255. But that was a very exceptional condition of things, was it not ?—Yes, it was rather exceptional; but on the other hand the high price of German spirit now is also exceptional. That 5d. is supposed to be an allowance to the English distiller for the extra cost of his manufacture in having to work under the Inland Revenue regulations.

Proportion of wood naphtha used for methylating. Suggested reduction from 10% to 5%.

4256. You suggest at the end of your *precis* that under certain conditions the amount of wood naphtha added, instead of being 10 per cent. might be reduced to 5 per cent; why is that ?—Take, for instance, Pears' soap I think Pears would willingly accept 5 per cent. of wood naphtha rather than have the attendance of the officers, which they would object to, not on account of their

Mr. B. Biggs. 10 Jan. 1905.

attendance but on account of the expense. I think it would be cheaper for them to pay the extra cost of the 5 per cent. of wood naphtha.

4257. That is, as an alternative to using free spirit under supervision?—Yes.

4258. Of course if they use the ordinary methylated spirit now, containing 10 per cent. of wood naphtha, they are practically under no supervision?—That is so.

4259. As a matter of fact Messrs. Pears do use the 10 per cent. methylated spirit. Do you think that the 5 per cent. would be sufficient for protective purposes?—I think that would protect the Revenue.

4260. A spirit mixed with only 5 per cent. of wood naphtha would not be very nauseous in itself, would it?—It depends upon what a person's taste is. There was one works in the country which I knew very well, and they had an old stillman whom we used to call "Old Bill." I sent down to the works a can of methylated spirit when it was first brought in, and the next time I went down Old Bill came to me and said, "Could you send master another drop of that stuff; that was fine"—but then he used to drink the wood naphtha alone.

4261. So that it was an improvement in his case? Yes. A great many people would drink it, perhaps, but I think gin is so cheap that anyone in the ordinary way would not take methlyated spirit.

4262. (*Mr. Nicholson.*) Still, gin is not so cheap as methylated spirit—it is four times as dear?—That is so, but to use methylated spirit for drinking purposes would be an infringment of the law.

Probable effect of such reduction on security of Revenue,

4263. (*Chairman.*) Do you consider that the purification of a spirit which had no more than 5 per cent. of wood naphtha in it would be so expensive as not to make it worth while?—I think it would be quite as expensive as if it were free from the 10 per cent. It is simply a question of the boiling point. Wood spirit boils at about 143 degrees and ethyl alcohol at about 166 degrees.

4264. Have you paid any attention to the process of methylation adopted by other countries than this country?—Only by knowing what they do. I have an account of the different things that they have abroad.

4265. But you have not studied them closely at all?—I have not, and I really do not feel myself entitled to say whether I think one or the other would be a greater protection. I know that the Inland Revenue here think that anything which will not mix with water is useless to denaturise spirit, because adding water to it throws the oil out.

and on wood naphtha makers.

4266. Supposing that the quantity of wood naphtha that we required were reduced to 5 per cent., how would that affect your business?—At first I think it would be a loss to us, but I think it would recoup itself and would come round in the end.

4267. Because there would be so much more used?—More would be used. The quantity of methylated spirit used in Germany is far beyond anything we have here—it is ten times as much.

Government supply of wood naphtha (*See ante* Qs. 4215–22.) Return to old system not recommended.

4268. You would not advocate going back to the old system under which the Inland Revenue made themselves responsible for the wood spirit that was used for denaturing, would you?—It would suit me very well, because I daresay I should make the contract with them; but I do not think it would be a desirable thing looking at it from a broad view. I think the less the Government interfere with the manipulation of the business the better.

4269. Of course what you mentioned just now, namely, that it affects unequally different traders according to their geographical position, is a very strong objection to that?—Yes, but the Government could arrange to fix a price at which it could be delivered anywhere.

4270. Still your experience of the system as it was followed in the first instance does not lead you to think that it had any advantages over the present system?—I do not see that it would give any advantage to the real user of methylated spirit. Indeed it would be rather the other way, because we would assume that coming through the Government they would have their warehouse and their place to keep it in, and that they must add a little for that. Still it would suit me very well.

4271. (*Mr. Tyrer.*) When you speak of there being ten times the demand for methylated spirit in Germany that there is here, do you mean practically the same methylated spirit as our own?—Yes.

4272. Ten volumes of it?—They use several things, but still it is spirit made in a way which it is supposed cannot be drunk.

4273. By the word "methylated" then you mean denatured in some suitable manner for the industry?—Yes. You would know whether a smaller quantity of naphtha with the spirit would help you at all; do you think it would make any difference to you?

4274. I should like, being a manufacturer, to have no methyl at all; it is an inconvenience in some cases, but there are possible substitutes for it, are there not?—Yes.

4275. (*Mr. Nicholson.*) Do you think that it is unreasonable that the users of spirit should expect to be able to get the spirit always at the dumping price at which German spirit has been imported into this country?—Yes, that is so. It suited the German Government to get the land occupied in growing potatoes to make spirit, because they reckoned among the products of the land the men who serve in the army, and the men off the land make better soldiers than men out of the town. I have no doubt that that had great influence with the German Government. Then if the land had not been occupied the land would have been idle and the men would have had to have been kept, and even if the man only earns half wages that is better than his being idle.

4276. Because half a loaf is better than no bread at all?—Yes.

Price of acetic acid (*See ante* Q. 4229), enhanced by demand for acetone.

4277. (*Mr. Tyrer.*) To what do you attribute the advance in the price of acetic acid and of the acetates?—I believe it is chiefly because acetate of lime has been so largely used for making acetone for explosive purposes that the quantity of acetic acid made has fallen short. At the present time, as you know, acetic acid shows an advance of 50 per cent.

4278. You do not think that the advance is due to the American Government particularly becoming alive to the fact that they are depleting their forests without restitution going on at anything like a reasonable pace?—I do not think the question of the supply of wood has any effect upon it. During the last few months charcoal has been over-produced and there has been no demand for charcoal in America and consequently America has been sending charcoal to Canada. Their works therefore have been rather working short time. That is one of the reasons why the quantity of acetates has not come into the market. I have got acetone to come in now under £50 which is worth £75.

Home-made wood naphtha not appreciably more costly than imported. (*See also* Qs. 4223–4).

4279. You have stated that the amount of wood naphtha required for methylating in this country was 360,000 gallons per year, and that the home production in the United Kingdom and Ireland was only 140,000 gallons?—Yes, about that.

4280. Yet the price, I think I understood you to say, is about the same wherever produced?—Yes. I am importing foreign naphtha and paying a less price for it than I am giving to English makers. I work a little with the English makers and we try to keep the price up as well as we can.

4281. One is not to infer from that that we can produce in England as cheaply as abroad, are we?—Practically as cheaply.

4282. We can?—Yes. The raw material in either case costs very little. The material certainly has to be cut down, but then the labour of cutting it and putting it into the ovens must be the same everywhere.

4283. Then the enormous preponderance of woodland both in Canada and in the United States, and even on the Continent, has really nothing whatever to do with the cost of the wood naphtha?—I do not think it has anything to do with it. Practically there is a large supply of wood. Generally in Germany, Hungary and Bohemia the forests are owned by those who are interested in iron and they make an agreement with the chemical people to supply charcoal in place of the wood that they take.

Effect on the wood naphtha industry of possible con-

4284. Have you any idea—I think you have as a manufacturer who is interested in other departments of chemical production—what relief would on the whole be best considering all the interests that are involved, having regard, that is, to the interests of the Revenue, and having regard

Concessions to users of alcohol for industrial purposes.

to the legitimate interests of the industry, and then looking at the requirement for cheap alcohol for a wider range of industries in England? What do you think should be the relief that ought to be given?—I may be perhaps a little prejudiced as being interested in wood naphtha, but still I know of nothing at present which is proposed to the Government which can be used as a substitute for naphtha, at any rate not at a less cost. I have seen it proposed that varnish makers should be allowed to put the shellac into the clear spirit without any naphtha. To my mind that is quite unreasonable, because all that the man who has got a varnish with a clear spirit in it need do is to add some water to it; that will precipitate the gum and then he has got pure alcohol. That would open a great door for drinking, I think. My object, of course, is that I want to get the use of wood spirit continued. I do not want to have it cut off if I can help it.

4285. That being the *raison d'être* of your representative evidence—because this evidence you are giving here is in a representative capacity—do you really think that by any reasonable extensions under the provisions of the Act of 1902, or any conceivable modification of it, still having the interests of the Revenue in view, there would be any danger to the industry which you represent?—I really do not think there would be any fear of the Inland Revenue losing by it. If you had a methylated spirit with only five per cent. of methyl in it I should feel, in your place, that it was perfectly secure, but then of course I know the Inland Revenue have only one law for a first-class man and a fifth-class man, and the fifth-class man might try and do the Inland Revenue.

4286. That is scarcely what I wanted to get at, which was this: You are here partly because of a fear that the use of wood alcohol would be diminished by such generous and liberal extension of the facilities under the Act or any modification of it as might be given?—Yes.

4287. Do you really think, when you consider the increased industrial use of alcohol that would follow upon such an extension, that the use of your special denaturant, wood naphtha, would decrease in quantity?—Yes. If something else was used instead of wood naphtha I certainly think then that the quantity of wood naphtha required would decrease considerably.

4288. That is begging the question rather largely. You are aware, I suppose, that the preference—for very excellent reasons I think I may say—of the Excise is for wood naphtha?—It has been up to this time.

4289. The phrase which Dr. Thorpe has adopted from the very beginning is that wood naphtha "earmarks" any spirit to which it is added; and it is *par excellence* the material which does denature. With that conviction on the part of the Excise Department, there is very little fear of an extended use of other denaturants, or that your industry would suffer very much. There might be a diminution in certain cases, by the use of another denaturant in order to secure the Revenue, but the increased use which would follow in other directions would compensate for that and, as I think you and I have said, the distilling industry for instance would be benefited, whatever concession and allowance was made mutually, if there were a largely increased demand?—You would know better what you propose yourself; what would you propose yourself for your own trade? How would you denature the spirit that comes to you; and would you have an officer constantly in the place?—It depends, of course, on how much you would use whether it would pay you. Several of our customers have come to me about this and I have said: you must consider what quantity you would use, because the Inland Revenue would not allow you to have this privilege without constant supervision. Unless a man is using a considerable quantity it would not pay him to pay £200 or £250 a year to have an officer always in attendance.

4290. Holding those views, do you not consider that the danger to your combined industry, so far as the English producers are concerned, is a remote one?—Yes, partly remote; but still you must try and stop the leakage at the beginning or else it makes a breach. I recognise that it is hard for the English chemical manufacturer not to be able to get spirit on the same terms as the Germans get it, but I do think, and I think you also at one time did think, that with that 5d. difference he ought to get it. That was really a protection to the distillers, because they had to comply with certain rules. They are not anxious to get rid of it, because all our distilleries now are erected and carried on under the present regulations; and supposing for the moment that free spirit were allowed altogether, and they were allowed the liberty to distil as they liked, still they would have a great loss there, because a new man could put up half the plant and do as much business as they could with their present old plant.

4291. You do not know what a school of information this Committee has been to me?—Yes.

4292. (*Mr. Nicholson.*) You are understating the case?—Mr. Nicholson I know tells me that 5d. is no good to them, and is no advantage; and I think Mr. Octavius Smith used to say the same.

4293. (*Mr. Tyrer.*) I have some strong views on that point, but still I have learnt a good deal here?—All I want is that as far as it can be done the Committee should not lose sight of the fact that there is an industry of some importance that should be considered; that is, that they should not give you £1 and another industry lose 30s.—even you would not like that—at least you would not expect it.

Distillation of wood. High price of acetone has not led to its increase in this country.

4294. (*Dr. Thorpe.*) Has the price to which acetone has been forced up tempted the wood distillers in this country to begin again?—No, I know of no new works being started in this country. I have got a proposition before me now to start a works, but I say I am not going to start a works on the present value of acetone.

4295. I suppose we may take it for granted that although the price of acetone at the present moment is rather at an abnormal value, the probability is that it will continue, compared with what it has been, relatively high?—I do not know why it should not go down again. You cannot tell how long the Russians and Japanese are going to fight.

4296. But the growing demand for smokeless powder of a particular kind is sure to require constantly increasing quantities of acetone?—I am a peace man and I should hope not.

4297. You do not see any sign yourself—and no one would know better than you—that a number of those works which had closed down are beginning again?—No.

4298. I understand that as recently as 1880 there were no fewer than 24 wood distillers in Scotland, whereas there are now only about nine?—I should say twenty-four was a very large number, and that that would very likely include three or four branch works. For instance, Turnbulls, of Glasgow, were large makers, and they had several small works through the country

4299. Are Turnbulls still distilling wood?—Yes.

4300. But not to so large an extent as they were?—I do not know; I should say about the same.

4301. Are pyrolignites used as much as they were by the calico printers?—Yes, as far as I know.

Excise regulations as to sale of methylated spirit. (*See ante* Qs. 4242–4.)

4302. In answer to the Chairman as to the Inland Revenue Regulations, which you thought to some degree hampered the trade, the only one that you made reference to was as to the cost of the licence?—I referred to the cost to the man who would sell twenty or thirty gallons per year.

Suggested relaxation.

4303. Are there any other regulations that you think rather hamper the trade?—Having, under the supervision of the officer, made the methylated spirit, I think then it should be free from the Inland Revenue, and that it is not worth their while bothering themselves any more about it.

4304. The system of permits no doubt is useful to the Inland Revenue, because it enables them the more readily to trace spirit which has not been subsequently ear-marked, as we may say, by the addition of petroleum; does that system of permits add considerably to the difficulties of using the spirit?—Everyone avoids trouble as much as he can. We have to send the permit away, and we tie it to, say, a ten gallon can. The railways are careless; perhaps they pull it off, or where it goes to they may lose sight of it, and then the permit is lost. That leads to correspondence, and the question is asked what has become of it.

4305. Are all those very serious difficulties—they may be little annoyances it is true?—They are not serious, but when there are little things of that kind one man will say, "I will have nothing to do with the Inland Revenue interfering with me.

Mr. B. Biggs. 10 Jan. 1905.

4306. (*Mr. Tyrer.*) Is there not a direction in which facilities might be granted without very much trouble, namely, the extension of the one-gallon retailer's licence; would that not follow on the lines of what you desire?—Yes. I do not know why a man who is allowed to sell one gallon at a time and not more than two gallons a day, I think, should not be allowed to sell ten gallons. Anyone who wants to defraud the Revenue has simply to take a shop and pass himself off as a polish-maker, and then the Goverment will give him facilities for getting the spirit without the mineral in it.

4307. (*Dr. Thorpe.*) Yes, but he has to take the shop; he has to enter into negotiations for the hire of the premises, all of which is certainly a good deal more trouble than the system of permits?—Not if he is going to defraud the Revenue—at least that is the way I think I should do it, or try to.

4308. You would not mind taking the £20 shop for the purpose?—Practically I do not believe that methylated spirit can be rendered potable except to a depraved taste.

4309. (*Mr. Tyrer.*) Therefore, you think that so far as the retailer is concerned, he, at any rate, might have considerable latitude?—Yes.

4310. In the case of the possible and probable and dessired use of a denatured spirit, such as methylated spirit for heating, lighting, and, I would say, motoring, would it not be desirable to give to the retailer, particularly in the country districts, some latitude?—I think so. I think there are a great many places where, if you wanted a gallon of methylated spirit, you could not get it.

Wood naphtha for methylation. Specification of Government test has helped the producer by giving him a standard to work to.

4311. (*Dr. Thorpe.*) You are aware that some few years ago the Government laboratory rather more accurately defined the nature of wood naphtha which they would sanction for the use of methylators, and you are no doubt aware of the existence of the regulations then issued?—Yes. I think that arose from a communication we made to the Inland Revenue. Formerly methylated spirit had no standard and then we got sometimes a notice "You are very near the dividing line"; so I asked if they would make a particular regulation so that we could define the spirit, and see what was required. It really arose from our representations.

4312. Your recollection of exactly how this came about does not quite agree with mine; however that is a detail. In any case you are not aware that this definition has in any way hampered you?—No, because if I have got a spirit I can have it tested, and then I know whether the Government will take it or not; but previously I might send in a parcel and they might reject it, and I should not know why it was rejected.

4313. Then you think it has rather facilitated your procedure?—Yes; that gave the spirit a sort of standard.

But advantage has not been generally taken of it for supplying special qualities of naphtha to meet requirements of particular traders.

4314. (*Mr. Nicholson.*) Do you supply different qualities either of naphtha or of methylated spirit to your various customers?—We only supply two qualities; one mineralised and the other not.

4315. There are no modifications of the non-mineralised naphtha then?—No.

4316. It has been pointed out by Dr. Thorpe to some of the previous witnesses that to some extent they had the control of the quality of the methylated spirit in their own hands?—All we try to do is to give them naphtha as pure as we think it will pass. We have the Government standard before us, and we make it as pure as we can to pass that.

4317. Do not the large users come to you and ask for special modifications?—I should not give it to them if they did.

4318. (*Dr. Thorpe.*) May I perhaps recall to your recollection the fact that a company engaged in the manufacture of artificial silk in the neighbourhood of Coventry asked you for a particular type of wood naphtha?—We could only say to them if it were after the regulation that we must conform to the Government standard; that we should get it as good as we could, but it must pass that.

4319. May I point out to you what these regulations say? They give obviously, on the face of them, very considerable latitude in the character of the naphtha; because they say that as regards the methyl alcohol the the amount shall not be less than 72 per cent. by volume and they do not say that it may not be much more than 72 per cent.?—But I do not think more acetone would help them at all.

4320. I am talking of the methyl alcohol. Then the regulations go on: —"Not more than"—mind, as regards the methyl alcohol, the wording is "not less than 72 per cent.," but as regards the acetone it is "not more than twelve grammes per 100 cubic centimetres"?—That is so, but I think the acetone would be as objectionable as any naphtha; the acetone being more volatile, it affects the nose and the eyes in working.

4321. (*Mr. Nicholson.*) A smaller amount might be used if you were called upon by your customer to supply a methylated spirit with less than 12 per cent. of acetone?—Then we must go below the 72 per cent. of methyl.

4322. But you might reduce your 12 per cent. of acetone if your customer wished?—Practically we cannot with the methyl alcohol.

4323. But I am speaking of the acetones?—I think the more acetone there is, the more volatile and the more pungent it would be. Sometimes we get a sample as high as 75 per cent. of methyl alcohol, but then we always use that to bring up some that has come rather below.

4324. (*Dr. Thorpe.*) You need not do so. If your customer came to you and said: "For special reasons I require a wood naphtha containing as much methyl alcohol as you can give me and as little acetone as you can give me," we should not object?—Practically we have never done such a thing. We have supplied what we call the sweetest naphtha that we could get passed.

4325. (*Mr. Nicholson.*) My point rather was this—supposing they did take advantage of those regulations to that extent, do you think that it would assist their trades if they were able to use a special methylated spirit, seeing that they now tell us that they cannot use the ordinary methylated spirit?—I do not know about that. I should not think it could make any difference.

4326. Not a sufficient difference, you mean?—No. The Government would not, of course, pass pure methyl.

4327. No. But they would pass a methylated spirit made in conformity with the regulations?—Yes, but a difference of 5 per cent. or say 7 per cent——

4328. Would not be sufficient, in your opinion, to bring it into larger commercial use?—No, I do not think it would. Of course, you know there is a large quantity of spirit—they call it Columbian spirit—sold in America which is open to anyone to take; but then the opinion in America is that wood spirit is poisonous, and people do not drink it. I had a sample of wood spirit some years ago, and a distiller came into my office, and as we were talking I handed the sample to him. I said, "Here is a new make of spirit that I have got." He smelt it, and he said, "Give me a glass of water to mix with it." He mixed it, and he said, "I thought there was something queer about it, but that is all right, it is a good spirit." I said, "It is not alcohol at all; it is wood spirit." The price of purified wood spirit is now about equal to 7s. per gallon.

4329. (*Dr. Thorpe.*) There is a type of methylated spirit which we have sanctioned for a particular purpose, in which the amount of methyl alcohol is as high as 82 per cent.?—I do not know where they can get it from—that is, without they buy the pure stuff—I mean I do not know how they can get it at the ordinary price.

4330. I cannot tell you exactly how the consumer gets it, but parcels come to us regularly, and we determine the amount of methyl alcohol and other things in them. That is habitually done. I do not know how you did it, but you did manage to supply to the Coventry people at Wolston, who started making artificial silk, a very high quality of wood naphtha?—Very likely I got some special naphtha for them. I should probably have asked Turnbulls for it in that case.

Refinement of wood naphtha in Germany.

4331. Is it a fact that in Germany a considerable quantity of wood naphtha is fractionated and refined?—Yes.

4332. And that the acetones and the methyl alcohol are taken out?—Yes.

4333. That is not done to any large extent in England, is it?—No, we are not allowed to do it.

4334. Why? What is to prevent you fractionating wood naphtha?—Simply because if we had a wood naphtha purified up to a certain point the Government would require 11s. per proof gallon.

Suggested use of residue (solvent naphtha) as a denaturant.

4335. But you need not get it so pure as that. Is it the fact that the residue of the wood naphtha which has been partially deprived of its methyl alcohol and acetones by the German distiller comes over to this country?—No, I do not think it does.

4336. Did it never do so?—I could not say it never does, but practically you see if you have got as a sort of standard 70 per cent. of one and 10 per cent. of another, that is 80 per cent. there would not be much left to come over.

4337. Where does the main quantity of what is called solvent naphtha come from?—The quantity of that is really very small. We import our naphtha from America, we distil it here and we have a certain quantity of methyl alcohol fit for methylating, and we also get a certain quantity of what we call solvent naphtha, which is used as a solvent. It is rather a better solvent of some gums than is the pure methyl or the ordinary methyl.

4338. But that solvent naphtha is practically wood naphtha deprived of a certain quantity of methyl alcohol and of acetone, is it not?—Yes, or rather I should describe it as what is left after taking out the methyl alcohol and the acetone.

4339. It contains the higher ketones and other substances of higher boiling points than methyl alcohol?—Yes.

4340. It is much cheaper, is it not, than the ordinary wood naphtha?—It is not very much cheaper; it is about 8d. or 9d. per gallon cheaper.

4341. That is a considerable amount. Is that a substance which might be used for denaturing?—No, I do not think so.

4342. Why not?—I do not know why not; but there would not be a sufficient quantity of it. If the Government were to allow it to be used it would come to about 50 to 52 over proof.

4343. That solvent naphtha, of course, much more closely approximates to the boiling point of ethyl alcohol than of wood naphtha, does it not?—No, it would be below the boiling point of the wood naphtha.

4344. The solvent naphtha which contains the higher ketones would boil at a little higher temperature than the original wood naptha, would it not?—I should have said the other way.

4345. What things more volatile than acetone and methyl alcohol are there to any large extent in wood naphtha?—You see it is not of so high an over-proof strength, but I really cannot say that I have ever tried or looked at the question of whether what we call the solvent naphtha is of a higher or a lower boiling point.

4346. That we can easily settle. My point rather was this—that if there is a demand for methyl alcohol and for acetone such as to make it worth while for them to be extracted by some process of fractional distillation, the residues might under certain circumstances be used for the purpose of denaturing spirit?—Quite so, if the Government would allow it.

4347. Of course the Government is open to representations as to proper denaturants?—But I do not think the quantity would be at all sufficient to make any effect on the market. We get crude American naphtha over here; we distil it and we get about 85 per cent, of a suitable naphtha for the Government and 15 per cent. of a naphtha which we use as a solvent naphtha.

4348. I am rather trying to combine your suggestion to minimise the amount of the denaturant with the possibility of using a material, which, from our point of view as excisemen, is a sufficiently indicative and protective substance. Of course I speak without prejudice, and have not as yet looked into the question fully, but it seems to me that it is possible to conceive that this substance, which otherwise is a waste product—for solvent naphtha is largely a waste product—but which could be produced much cheaper than either methyl alcohol or acetone, might under at all events certain circumstances be a sufficient denaturant?—I do not think there would be any quantity of it; at any rate no quantity to speak of.

4349. Do you think there would not be sufficient even if the amount of the denaturant required were reduced to one half of what it is now?—Certainly, there would not be.

4350. (*Mr. Tyrer.*) What is the nature of that 15 per cent. which Mr. Biggs gets out of the crude naphtha which he imports from America?

4351. (*Dr. Thorpe.*) It is composed of the higher ketones and, I believe, is very largely used in Switzerland as a denaturant. Those higher ketones are being used to a growing extent; they are present in the methylene of the French to a much larger extent than in ours, and they are present also to a very large extent in the Swiss material.

Acetone oil.

4352. (*Mr. Tyrer.*) There has been an increased demand for the supply of acetone oil, has there not?—Yes. We call it all ketones, or oil, or whatever it may be. I am giving as much as £40 per ton—that is about 2s. 8d. per gallon—for some.

4353. What is the use to which it is applied chiefly?—We sell it to the celluloid people chiefly as a solvent.

4354. (*Dr. Thorpe.*) They can use the mixed acetones instead of acetone pure and simple, can they?—I could not say that they use acetone with it, but if we are asked for something dissolving, we give them a sample. How they use it goes beyond us.

4355. (*Mr. Tyrer.*) Do you know whether if that acetone oil were added to the spirit it would make it even more objectionable and impotable than using the approved naphtha?—I do not think there would be much difference but I have never tried or tested it or mixed it in any way. In our first contract with the Government we supplied them with a good deal of acetone, and we called it a wood naphtha at that time. The acetate of lime was at a very low price, and at the 8s. 6d. per gallon which we got for the product we made a large quantity of it, or rather the different makers made a large quantity. We called it all wood naphtha; and that has been made from time to time according to the price of acetate of lime.

4356. (*Dr. Thorpe.*) By English makers?—By English makers.

High price of acetone may make it desirable to minimise its use for denaturing.

4357. Perhaps you know that acetone is actually extracted directly from wood naphtha by the German distillers?—It may be extracted, but they would have a great difficulty in getting the very pure acetone from it. We are occasionally offered wood spirit containing 50 per cent. of acetone, and then they want me to give more for that than I would for the wood spirit alone. Of course I could not deliver it to you—you would not take it.

4358. What I think we must contemplate is that if the present high price of acetone keeps up, some pressure will be brought to bear upon us—I do not know why we should resist it—to take a denaturant with a minimum quantity of acetone in it?—I do not think that would really make any difference, because the ordinary quantity of acetone that arises in the wood distilling is 10 or 12 per cent., or as much as 15 per cent. I do not think that here in this country the wood distillers pay the attention that they ought to the temperature at which their ovens are worked.

Acetone not at present recovered from wood naphtha in this country.

4359. Probably not, but anyhow, if they are wise they will produce as much acetone as they can; do they not try to recover the acetone?—No, I do not think anyone does.

4360. Why should they not? Acetone is worth about 6s. per gallon at the very least, is it not?—Yes.

4361. The wood naphtha *en bloc* is only worth, as you say, from 2s. 9d. to 3s.?—That is so, but then you must take that 6s. per gallon as being the price for the pure material, but the cost of making pure acetone is considerable, and, commercially speaking, impossible as far as it has been discovered at present.

4362. By fractionation I should think it would be possible to get out, I will not say an absolutely pure acetone, from the wood naphtha, but a character of acetone which is quite good enough for a large number of commercial purposes to which acetone is put?—The

Mr. B. Biggs.
10 Jan. 1905.

consumption of acetone is really and practically all in connection with smokeless powder.

4363. I do not think 100 per cent. of acetone is required as a solvent for that purpose ?—That I do not know, but I know what people bargain to get. I have from time to time had naphtha with a large quantity of acetone, say with 50 per cent. of acetone, but I do not find that such people as Curtis and Harvey care to look at it.

4364. (*Mr. Tyrer.*) As a matter of fact the Government Specification for acetone is extremely high, is it not ?—Yes.

English-made wood naphtha. Sources of supply of wood. (*See* also Qs. 4209-12.)

4365. (*Dr. Somerville.*) Am I right in thinking that you said there is something over 300,000 gallons of wood naphtha used in this country annually ?—Yes, 360,000 gallons, I called it.

4366. And of that quantity something over 100,000 gallons is home produced ?—Yes, 140,000 gallons, I said.

4367. Are these 140,000 gallons produced from home-grown raw material ?—Yes.

4368. It is not a case of getting over a crude product from America or some other place and purifying it here ? There is a certain quantity which comes over from America and is purified here, but when I speak of 140,000 gallons I mean 140,000 gallons distilled from wood in this country.

4369. Is a certain quantity of it prepared in Ireland ? —I know of no works there. A friend of mine from Bradford put up a works in Ireland, but after he got the thing into work the men struck for higher wages, and the thing was all broken up.

4370. What wood is chiefly employed for the production of this naphtha ?—All hard woods. Elm is not a good wood.

4371. Chiefly oak, I suppose ?—Oak or beech.

4372. But not conifers ?—No.

4373. Are there any other sources of supply of this naphtha except wood ?—Not that I know of.

4374. It cannot be produced, so far as you know, in any quantity from coal tar or any other of the coal products ? —No.

4375. I think you emphasised the point that the original raw material, which is wood, is of practically no value both in America and also in this country ?—I say it is of no value in this country; that is, the wood that is used for chemical purposes. It is part of the tree that has to be cut down for the paying parts of it—for timber and what they call the mining wood, mining wood being anything which is about six inches in diameter. Below that there is no use for the wood except to burn it.

4376. But in point of fact, do they not grow oak coppices for the express purpose of distilling the wood for wood naphtha ?—Yes.

4377. In that case they distil the whole crop that comes off the ground ?—Yes, and it takes about twenty years to grow.

4378. Surely you would not say that in such a case at any rate the raw material is of no value ? It is the produce of English land; it has taken a certain time to grow; it has had to be protected against rabbits, and it has had to be thinned and generally treated ?—I do not know any place now in this country where there is any wood grown simply for chemical purposes. Formerly they paid a higher price for it, and where they got sporting land a twenty years' growth would give them a chemical product; but I do not think that then it was grown for a matter of profit and loss; it was grown for other conveniences.

4379. Are you acquainted with the Loch Lomond district of Scotland ?—No, not much.

4380. Perhaps you know there are large distilling works at Balloch which is kept going upon the coppices of Loch Lomond ?—Yes, that is Turnbulls' Works.

4381. (*Chairman.*) What quantity of wood naphtha do you get from a ton of wood ?—About 3½ or 4 gallons is as near as I can say. There is a little over one hundredweight of acetate of lime.

Quantity of wood naphtha produced per ton of wood.

MR. JOSEPH TURNER, called; and Examined.

Mr. J. Turner.

4382. (*Chairman.*) You are Chairman and Director of Read, Holliday, & Sons, Limited, Aniline Dye Manufacturers, Huddersfield, are you not ?—Yes.

4383. Is yours an old-established firm ?—It was established in 1830.

4384. What were they originally ?—Aniline dye manufacturers.

Messrs. Read Holliday & Sons, Ltd., export business in aniline dyes and intermediate products.

4385. But not in 1830, surely ?—Very soon afterwards —two or three years afterwards. They originally commenced with naphtha—that is one of the coal tar products —and from that they gradually developed into coal tar manufacturers—they were one of the first in this country.

4386. And they have continued that business ever since ?—Yes.

4387. Does the whole of their business consist in this aniline dye manufacture ?—Yes.

4388. Do they do any export business, or are their products all used in this country ?—We do a very large export business.

4389. To what parts of the world ?—To all parts of the world.

4390. Not to European countries, I suppose ?—We export a large quantity to America, Germany, France and Switzerland.

4391. Do you manufacture any special colours ? Have you specialities in your manufacture ?—We have some.

4392. How comes it that you can export to Germany ? —Where we have equal privileges and rights of making we can offer competition against those people.

4393. I suppose it is in some rather special lines, is it not, that you can compete with Germany ?—We compete in the most cut lines of the whole business in Germany.

4394. In what particular sorts of colours ?—In aniline oil for instance.

4395. (*Dr. Thorpe.*) Do you regard that as an intermediate product or a finished product ?—You may either call it an intermediate product or a finished product. Aniline oil is a product that is used for dyeing or for colour manufacturing.

4396. (*Chairman.*) Then in fact it may be either an intermediate product or a final product ?—Yes.

4397. In what way does the price of alcohol affect your business ?—In years gone by we used to manufacture di-ethyl and di-methyl aniline from aniline oil, and these we used to sell in large quantities to Germany, to Switzerland and to other places where aniline colours were manufactured. From the di-ethyl and di-methyl we used to manufacture violets and greens, but some twenty years ago we had to discontinue this, the competition being so keen that we could not use alcohol with the duty on it any longer.

Di-methyl aniline. Manufacture discontinued owing to foreign competition.

4398. Taking the dimethyl aniline, up to what date did you manufacture that ?—I should think about twenty to twenty-five years ago.

4399. When you were manufacturing it did you use purified wood spirit and pay the duty on it ?—We used pure alcohol—as pure as it was possible to get it at the time.

4400. But you must have had methyl alcohol ?—Both methyl alcohol and ethyl alcohol.

4401. The di-methyl aniline must clearly have been manufactured with methyl alcohol ?—Yes.

4402. When you were manufacturing that did you use wood spirit purified so as to be potable and therefore so as to be liable to duty, or did you use a wood naphtha which did not pay duty ?—That is something I really could not say.

See post, Qs. 4416-9.

4403. Were you connected with the works at the time ? —I was connected with the works, but indirectly. I mean to say I had no position to enable me to go into

these things very minutely in order to ascertain what was being done and what was not being done.

4404. That is a very important point. because if you used the wood naphtha which was not dutiable then you were at no disadvantage with the Germans or anybody else ?—Then ?

4405. Neither then nor now ?—Now we should be at a disadvantage.

4406. Why ?—Because the price of it is even more than the price for alcohol; and besides that, if methyl alcohol is used with a certain amount of wood spirit in, the effect on the yield is from 10 to 20 per cent.

Impure, i.e., duty free, methyl alcohol can be used, but gives a smaller yield. (*See* also Qs. 4422-3 and 4481-9.)

4407. If you can use wood naphtha which is not dutiable to make di-methyl aniline, surely there is no question of any advantage which the German has, because if he can get his wood naphtha cheaper than you can get yours, then you can import it at the same price that he pays ?—Yes, but you must understand that in these re-actions, such as dimethyl aniline, if you use methyl alcohol with a certain amount of wood naphtha in it the yield from the aniline is not so large by 10 or 15 per cent. as would be the yield from the pure spirit. The competition to-day is so regulated by the Germans that they send it in at just less than we can produce it at.

4408. (*Dr. Thorpe.*) The Chairman asked you about dimethyl aniline, and we are talking now not of alcohol mixed with wood naphtha, but we are talking of dimethyl aniline ?—Yes, I know that.

4409. You were asked whether you could not make your dimethyl aniline from wood naphtha, which is substantially methyl alcohol ?—We can make it, but if it is not absolutely pure the impurities in it have an effect upon the making of dimethyl aniline to the extent of 10 or 15 per cent. in the yield.

4410. (*Chairman.*) If that is the case then you must use wood naphtha purified ?—Yes.

4411. The German does not get that any cheaper than you do, because that is an expensive thing to make. The price of ordinary ethyl alcohol in Germany is very cheap, but methyl alcohol is not cheap in Germany any more than it is here, and there is no difference in the price ?—But still to-day have we no restrictions on pure methyl alcohol in England ?

4412. (*Dr. Thorpe.*) Try whether you have or not ?—We have, perhaps, not tried within the last twelve months, but we have tried and we have found that there is a restriction on methyl alcohol.

4413. (*Chairman*) If it is purified up to a high point, yes, then it becomes dutiable and you can only use it under a concession. But I am rather wanting to go into the history of this, because you state that up to a certain period you were able to make dimethyl aniline at a profit, I understand ?—Yes.

4414. But then there came a time when you ceased to be able to make it at a profit ?—Yes.

4415. What I want to know is when you were making it at a profit what were you making it with—were you making it with wood naphtha or were you making it with a wood spirit on which you were paying something like 20s. duty per gallon ?—I could not say exactly what was being done at that time, but I do not think that that bears very much upon the subject, for the simple reason that in those days 15 per cent. was scarcely considered in the profits that were being obtained from dimethyl aniline, whereas to-day 2½ per cent. is considered on the profits that are obtained from the manufacture of dimethyl aniline; therefore, if we used the one or the other it would hardly bear upon the question to-day.

Price at which the dimethyl aniline was sold indicates that dutiable methyl alcohol was not used.

4416. (*Dr. Thorpe.*) Can you name to us the price that twenty years ago you were in the habit of getting for dimethyl aniline ?—I could not say exactly, but I should think it would be between 2s. and 3s. per lb.

4417. We can infer from that whether you used duty-paid alcohol or whether you used duty-free alcohol ?—I should say the price would be between 2s. and 3s. per lb., and compared to that aniline oil would be something like 1s. then. To-day aniline oil is about 4d., and the other is about 7d.

4418. I venture to say you could not have been using duty-paid methyl alcohol when you sold dimethyl aniline at 2s. or 3s. per lb., because that would not cover the duty on it ?—That is something I would not be prepared to say.

4419. If you are accurate in your statement as to the price, I think you have answered the Chairman's question. He asked you whether you made it from duty-paid material or from duty-free material, and you said you did not remember, but if you know the price I think you have incidentally answered the question ?—I was not in a position then to go into these things.

4420. (*Chairman*) Still it is very important, because you have made the statement that you had to give up manufacturing this particular substance because of the duty on alcohol. If you were manufacturing it with an alcohol that was not dutiable, then the duty on alcohol had nothing whatever to do with it, and we must search somewhere else for the reasons why you had to give it up ?—That is a question that I might possibly be able to find out.

4421. It is of the utmost importance surely ?—Yes, but still if we manufactured it with an alcohol that had no duty payable on it—

Pure methyl alcohol now necessary for profitable manufacture of dimethyl aniline. (*See* also Qs. 4481-9.)

4422. It never had and it has not now— ?—Then it would be impossible to manufacture it with that alcohol to-day, for the simple reason that you cannot get within 15 per cent. of the theoretical yield when you use an impure alcohol that you can when you use a pure alcohol. Therefore, if we manufactured it twenty years ago when the amount of profit was larger than it is to-day, we cannot compete to-day although we could then.

4423. Then, in other words, it comes to this, that, whereas in those days it was possible to manufacture with the impure spirit, it is no longer possible to manufacture with the impure spirit, because the impure spirit does not produce sufficiently good results; that you think, is the real way to put it ?—Yes.

4424. You say in your *precis* that you now adopt some other agent than alcohol for the separation of the various isomers; what are the methods you now adopt ?—We have to use water with certain materials for precipitating the acids from the water. By that method it is impossible for us to obtain a pure product or a product that in some instances we could use to advantage.

Importance of alcohol in making colours.

4425. I suppose for a very large number of your products you do not wish to use alcohol, and there is no object in using alcohol ?—For some of them.

4426. Are there not large classes of these colours that do not require alcohol for their manufacture at all ?—A certain number of colours require no alcohol; but still on the other hand, I should say the majority do require alcohol.

4427. That is the majority of what you make ?—No, not a majority of what we make, because there are some that it is absolutely impossible for us to make without alcohol. Some that we do make we should make to a larger extent if we had alcohol instead of the materials that we are obliged to use at present.

4428. You do not suggest, do you, that the majority of the coal tar colours require alcohol now for their manufacture ?—Perhaps saying the majority require alcohol is using rather too large a word; but a great quantity of them do require alcohol, and you are absolutely bound to have alcohol or else you cannot manufacture them. I will give you a case in point that we have had very recently; that is the manufacture of rhodamine. That is a colour in which the patent has just run out; we were commencing to manufacture it, but the price has been reduced so that we cannot manufacture it; it is impossible to do it without alcohol.

Rhodamine. (*See* also Qs. 4549-55.)

4429. For that you would require alcohol in what form —would it be a methyl alcohol or an ethyl alcohol ?—We should require both methyl and ethyl alcohol, as there are two compounds made.

4430. Would you want to use it absolutely pure ?—Yes.

Finnace Act, 1902. No serious effort made by witness's firm to obtain benefit of its provisions.

4431. Have you made any application to the Board since the Act of 1902 to be allowed to use pure alcohol ?—We have really made no application to the Board, but we have tried it in the town, and we have had replies from the people there to the effect that restrictions would be necessary, and we dropped the matter.

Mr. J. Turner.

10 Jan. 1905.

4432. What do you mean by the people in the town?—The Excise authorities in the town.

4433. Have you had the printed papers?—Yes, we have had printed papers.

4434. What do you regard in those papers as fatal to your making an application to the Board?—We have come to the conclusion that we do not see any possibility of having the stuff duty-free.

4435. What were the particular regulations that made you come to that conclusion?—We were to build certain places, and to have certain restrictions put on, such as charges for supervision; and then we could only have alcohol of a certain percentage granted to us which would be practically of no use whatever.

Reasons adduced for not pursuing the matter.

4436. Are you quite sure that you have studied the regulations? Of course, you could not be allowed to use duty-free alcohol and other alcohol side by side; and in a sense you might be required to have a separate place for the duty-free alcohol. Was that the great objection?—No, not at all. We should not mind putting a place down any time to store the stuff in, and to keep it separate from anything else.

4437. I should like to know exactly what in these different regulations prevented you from proceeding further. Have you seen this paper, for instance?—(*Handing to the Witness print of "Procedure to be observed in Connection with the Use in Manufactures of Spirits on which Duty has not been paid [Section 8 of the Finance Act, 1902] dated 1st October, 1902"*)—I do not know that I have seen that one before.

4438. Have you seen this one?—(*Handing to the Witness print of Minute on Section 8 of the Finance Act, 1902, dated July, 1902.*)—I think this is the one I saw.

4439. What is your idea of the quantity of alcohol which you would want in the course of a year, supposing you were allowed to use it duty-free?—That is something I really could not say anything at all about, because the scope for colours from alcohol is so large that it would be very difficult to tell.

4440. Still, if you make an application to be allowed to use duty-free alcohol, you must have some idea in your mind of what at any rate would be the minimum quantity that you would use. Making every allowance for the expansion of your business later, you must have an idea in your own mind of what you would begin with, must you not?—Yes, but you see this business is so very large that it is difficult to tell. For instance, to-day you may get an order for a couple of tons of some of these products, and to-morrow you may get an order for 50 tons or 100 tons. It is not a thing that is done in a small way, at all; it is done in a very large way.

4441. But still, you have a strong conviction that you could do a profitable trade in this particular way if you were allowed to use alcohol duty-free?—Yes.

4442. You might, with the consent of the Board of Inland Revenue, practically be allowed to use alcohol duty-free; but you have never approached the Board of Inland Revenue to know precisely what their conditions were. One of the first things you would have to make up your mind about, when you made your application, is that you would have to state the sort of quantity you proposed to use. Surely you must make up your mind about that?—It is a very easy matter to make up your mind about the quantity—for the present, 5, we will say. That is a thing that we could do; but, as I say, our business is so large that to-day I might tell you that we should use this year perhaps 5,000 gallons, and I may use 20,000 gallons. It is a thing that jumps about tremendously. You could not confine yourself to a certain quantity unless you were going to regulate your output and do no more.

Necessity for Excise supervision admitted.

4443. I suppose you admit that neither you nor anybody else in this country can be allowed to use absolutely pure duty-free spirit without some sort of supervision, and without certain conditions more or less stringent?—Yes.

4444. Under the Act of 1902, which has been passed now some two and a half years, it is possible for you to do that. Why have you not made an application to the Board of Inland Revenue to be allowed under that Act to use duty-free spirit? You cannot be waiting for something better than that Act, can you?—We have approached the excisemen in our town, and we have found such difficulties in our way that really we have not cared to go any further.

4445. Whom did you approach; did you approach the collector?—Yes.

Messrs. Read Holliday and Sons' application under Finance Act, 1902.

4446. What did he say to you?—He gave us to understand that it was practically an impossibility to have duty-free alcohol.

4447. Have you had correspondence with him?—Yes.

4448. How long ago?—We had correspondence, perhaps eighteen months ago, when we knew that this Act was passed, and in force, and we have had correspondence perhaps within the last two or three months.

4449. You seem to me to have been satisfied to be deterred from proceeding with this manufacture on very little ground. I cannot understand that any one of our officers should tell you it was impossible, in the face of the Act which gives the Board power to do it. I rather gather that you have had the Regulations before you, but that on reading them through you have come to the conclusion that it would not pay you to make an application; is that so?—We have made an application.

4450. Not to the Board?—We have made an application to the Excise authorities in the town.

4451. But that was not a formal application, because if you had made a formal application it would have been sent up here. Without your knowing it there could not have been a formal application sent in, could there?—Not without my knowing it.

4452. However, we will take it from you, that you are anxious to be allowed to use duty-free alcohol?—We are very anxious to be allowed to use duty-free alcohol.

4453. Are you prepared to submit to such conditions as may be considered absolutely necessary for the protection of the Revenue?—Yes, we are quite prepared to do that.

Requirements of the Revenue explained.

4454. Then would not your best plan be to formulate the definite propositions which you would like to submit to the Board of Inland Revenue as to the mode of proceeding—what quantity you would use, and what guarantees you could offer in the way of protecting the Revenue from undue loss or anything of that kind—I mean guarantees for the proper use of the spirit for the purposes of your business?—Of course, those things we have gone into as far as the Excise authorities in Huddersfield go, and we are quite prepared to do any thing in reason.

4455. I think you had better look into that a little further at once?—Yes; but still the question holds good, if we do look into that, is there any possibility of our having alcohol duty-free.

4456. Other people are having it?—Not a pure alcohol are they?

4457. (*Dr. Thorpe.*) You are in Huddersfield, are you not?—Yes.

4458. Do you know any firm in the neighbourhood of Huddersfield which enjoys this concession under the Act of 1902?—Not of using pure alcohol.

4459. What do they use?—I suppose they use a certain amount of alcohol and water.

4460. They use such alcohol as they choose to purchase; we do not say how much or how little water they should put in?—Are you prepared to give to these people and to ourselves the same concession of pure alcohol?

4461. What is it you mean by pure alcohol?—I mean a spirit containing perhaps 95 to 98 per cent. of alcohol.

4462. There is no difficulty whatever now in getting a 97 per cent. spirit as a commercial article, and 95 per cent. is quite common. The Board of Inland Revenue raises no objection under the Act of 1902 to your obtaining 95 to 97 per cent. alcohol, which is what manufacturers are turning out every day, or can turn out?—Duty-free with certain restrictions on?

4463. Duty-free, with such restrictions as the Chairman indicated, which are complied with by your competitors in Huddersfield?—Thank you.

Conditions of denaturing.

4464. (*Chairman.*) And by your competitors in Germany. When the alcohol is brought into your premises,

before you actually use it, you would probably be required to put into it something which would render it temporarily unpotable—probably something which is ancillary to the particular purposes that you are going to apply the alcohol to. There would probably be no difficulty about that. After all, your German competitor is not allowed to use alcohol absolutely pure; he has to put something into it before he begins to use it, and you would have to put something in too; but what that something would be would depend upon the nature of the manufacture that you are going to undertake. Subject to that there is no sort of difficulty?—I did not understand that.

See Mr. J. W. Leitch's evidence, Q.s 3025–3116.

4465. (*Dr. Thorpe.*) We have had a witness from Huddersfield who works under this concession, and there is no particular reason that I can see why you should not apply on behalf of your company to do the same thing?—It is quite new to me to know that we can obtain absolutely pure alcohol, or from 95 to 98 per cent. alcohol, duty-free, with certain restrictions on it.

4466. Apparently you have never taken the pains to try and find out?—We have taken a lot of pains to try and find this out.

4467. They have not been very effective pains. Still, why should Messrs. Leitch & Co. have succeeded in doing that which you apparently know nothing at all about?—Messrs. Leitch & Co. are not using pure alcohol?—

4468. They are using an alcohol denatured with something which they themselves suggested as sufficient to protect us and them?—I was not aware of that.

4469. (*Mr. Tyrer.*) I understand you have seen the Procedure to be observed under the Finance Act of 1902?—Yes.

4470. In paragraph 2 it is stated: "The applicant must give full particulars of the situation of the premises"—that is easy enough—"the purpose for which the spirits are to be used"—that, too, is easy—"together with a description of the process or manufacture"—that is reasonable. "He must also state the means by which it is proposed to make the spirits unpotable before and during use, and the quantity likely to be required in the course of a year." Every one of those conditions, from beginning to end, has been answered to the satisfaction of the Board by the competitor who has been referred to; and, as a matter of fact, he has used pure alcohol, suitably denatured with a substance which does not interfere with his manufacture, but which, as the Chairman has just observed, is ancillary to it. It is an interesting point, in view of his evidence, which I myself heard, sitting where I am now, if you should not have received some sort of encouragement from the local Excise authorities to come direct to the Board, and ask in your own words for what is practically contained in this paragraph 2?—This is new to me.

Messrs. Read, Holliday and Sons' application under Finance Act, 1902.

4471. (*Chairman.*) I find that on the 15th January, 1903, you did write us a letter saying that you were large manufacturers of aniline and other colours, in which you said: "We therefore beg to apply for permission under clause 8 of Finance Act, 1902, to receive spirits without payment of duty for use in the above manufacture". That was sent up to us, and I think you must have sent that up through the local supervisor. It was sent back to the local supervisor with instructions to ask you a series of questions, namely, in what manner you proposed to use the pure spirit, in what respects ordinary unmineralised methylated spirit would be unsuitable for such purposes, and how you would propose to render the pure spirit which you asked permission to employ unpotable before and during use. We added: "All necessary details of the manufacturing process, so far as it involves the use of spirit, should be given in order that the Board may fully understand how the pure spirit would be used." That was sent back to our collector at Huddersfield, and we heard nothing more for a time. On 19th February, 1904, the supervisor for the Huddersfield district reported that "Messrs. Read, Holliday and Sons have failed to furnish me with the information necessary for report, although their attention has again and again been directed to the omission. They had mislaid my written queries dated 17th February, 1903, and on the 8th October last a copy of these queries was sent to them, and they still remain unanswered." That does not look like very energetic action on your part, does it?—It does not, from the reading of that.

4472. (*Dr. Thorpe.*) I have got the whole of the circumstances here before me. The original application on behalf of Messrs Read Holliday and Sons was for the use of ethyl alcohol in the manufacture of dimethyl aniline—that was all they made reference to. The remark that I made upon the papers when they came before me was that I could not understand why pure duty-free alcohol is required for the manufacture of dimethyl aniline; and I suggested that the queries which the Chairman has mentioned should be sent to the firm; and they apparently could not tell me why ethyl alcohol was required for dimethyl aniline?—You do not mean to say that the firm asked you if they could use ethyl alcohol for the manufacture of dimethyl aniline, do you?

4473. That is exactly what the firm did, and the remark I made is, "I cannot quite understand why pure duty-free spirit should be required in the manufacture of dimethyl aniline, and before considering this application I think the Board should request the firm to state clearly so and so." Apparently they found themselves unable to do that, and did not answer?—I think there must be some mistake there.

4474. (*Chairman.*) This is the letter: "We desire to use spirit, either English or foreign, for the purpose of manufacturing dimethyl aniline, which is an intermediate product," and then you went on to say that methylated spirits were quite unsuitable for the purpose?—I should think that is a clerical error, and that it should be ethyl alcohol instead of methyl alcohol.

4475. (*Dr. Thorpe.*) Anyhow you had the opportunity of rectifying it, as it was brought to your knowledge over and over again. The memorandum is that after several reminders the supervisor, on the 19th February, 1904, reports that no information can be obtained from the firm, and the Board are therefore unable to take any action or to make any order?—I do not understand it.

Methyl alcohol for making dimethyl aniline.

4476. (*Chairman.*) If you still have a mind to use pure alcohol, you had better renew your application. What you really want, at any rate for the dimethyl aniline, is to be allowed to use pure wood spirit?—Yes.

Aniline oil suggested as denaturant. (*See also* Qs. 4511-5.)

4477. If you were allowed to use that, what could you do to denature it; could you put into it something which was actually used in the manufacture of dimethyl aniline?—We could denature it with the aniline oil itself, of course.

4478. (*Dr. Thorpe.*) In the case of the Clayton Aniline Dye Company we gave them two or three alternatives at their own suggestion. We asked them what would suit them, and Mr. Green, who was the chemist of this particular works, eventually found, after trial, that one-twentieth of one per cent. of petroleum would answer the purpose. They got that concession, and they can use what otherwise would be dutiable methyl alcohol. They add that amount of petroleum, and they say it suits them very well?—As far as putting anything into the alcohol goes, of course we could, as I say, put in the stuff we are going to use—that is, aniline oil; or we could put in either of the colouring matters.

4479. (*Chairman.*) In your *precis* you say that the dimethyl aniline is only one of a good many instances that you could give. Could you mention others?—There is di-ethyl aniline of course; that is a similar compound to dimethyl aniline.

4480. (*Dr. Thorpe.*) But of very much less importance, is it not?—It is not used so largely as dimethyl aniline. Then there is benzyl ethylaniline; that is another case where ethyl alcohol is used for the manufacture of greens.

Use of impure wood naphtha reduces yield of product (*See also* Qs. 4407-10 and 4422-3), but does not affect its quality.

4481. (*Chairman.*) To go back to what we were speaking of before, I understand you to say that wood naphtha, not sufficiently pure to attract duty, is unobjectionable for the production of dimethyl aniline, except in so far as it does not give you the same percentage result; but so far as it goes, say the 85 per cent. that it produces, it is quite good?—Yes, it is quite good.

4482. It is not so much its character as its productive efficiency that you object to?—It is really the impurities that are in it that we have to get rid of, which we do by distillation. Otherwise the dimethyl aniline from it is equally as good as the dimethyl aniline made from pure spirit, but the yield is deficient.

Mr. J. Turner
10 Jan. 1905.

4483. Taking two quantities of dimethyl aniline produced, the one with a purified wood spirit and the other with wood naphtha not so purified as to attract duty, in the one case you would produce 100 say, and in the other case you would produce 85?—Yes.

4484. But the 85 would in point of character and quality be as good as the 100?—It would be equally as good.

4485. (*Dr. Thorpe.*) Pardon me, but you never produce 100—the yield is never theoretical?—The yield runs from 95 to 100.

4486. (*Chairman.*) The only difference is the difference in the quantity produced, not in the quality of what is produced?—Not so much in the quality in the case of the dimethyl aniline.

4487. (*Mr. Tyrer.*) The impurities exert a deterrent effect?—Yes.

4488. And whether the yield be 90 or 95, or anything between 95 and 100 (which is very desirable—and in many departments I should like to see a nearer approach to 100 than one gets), yet the loss is greater in proportion if the 85 or 80, or 75 or 78, whatever it may be, is produced?—Yes.

4489. In other words, it is not the difference between the contents of the methyl alcohol so much as the amount of the impurity which determines the yield?—Yes, it acts on the aniline used and destroys it.

Question how far the cost of pure methyl alcohol is compensated by the better yield.

4490. (*Dr. Thorpe.*) Do you know what it is in this more or less purified wood alcohol which affects your yield?—I could not say that, but there is something in it that carbonises a certain quantity of the aniline.

4491. You do not know what the substance is?—I do not, but there is that in it which makes the thing absolutely insoluble, and it is impossible to bring it over.

4492. You know, I suppose, that you would have a considerable amount of latitude in your selection of the purified wood naphtha?—Yes. According to the impurities, the more or less yield; less impurity and more yield, more impurity and less yield.

4493. I mean to say that it might be possible to use a commercially purified wood spirit containing as much as 85, and probably a higher percentage amount of methyl alcohol?—It would be possible to use that, but really it is not possible to use it in comparison with the purified alcohol.

4494. (*Mr. Tyrer.*) Except at a price?—Except at a price.

4495. (*Dr. Thorpe.*) That is the point?—Yes.

4496. (*Mr. Tyrer.*) Suppose the difference between the 85 which is possible and the 100 is such as to outweigh the value of the higher percentage?—Then of course we should have to use it impure.

4497. You know as well as anybody in this world that a high state of purification and fractionation simply means extra cost?—Yes, but that extra cost does not mean that you are going to put 15 to 20 per cent. on the amount of your yield. It is not the matter of 15 or 20 per cent. on the alcohol; it is a matter of 15 or 20 per cent. on the dimethyl aniline that we have got to contend with.

4498. (*Dr. Thorpe.*) You can get a good quality of wood naptha containing, say, 85 to 88 per cent. of methyl alcohol at something like 3s. per gallon can you not?—Yes.

4499. Now for the character of pure methyl alcohol that you are talking about—say for a 95 per cent. methyl alcohol—you would have to pay something like 7s. 6d. to 8s. per gallon, would you not?—Yes.

4500. Is that difference of price between 3s. and, say, 7s. 6d. to 8s. not of itself a deterrent?—Yes, but you must understand that that comes to about 40d., and that would give under five pounds of dimethyl aniline, whereas you might have a loss of fifteen pounds at the very least.

4501. Dimethyl aniline sells at what per pound?—At about 8d.

4502. It is for you to determine how far it is worth your while to pay the higher price which a purified wood alcohol obviously necessitates?—Yes, that is a thing we are going into very carefully. We have tried crude alcohols—in fact, unpurified alcohols—and we have come to the conclusion that we cannot get a yield approaching that of the other, and the expense does not meet the difference by a long way.

4503. (*Chairman.*) You say that the price of dimethyl aniline now is 8d. per pound?—It is somewhere about 8d.

4504. Then it has fallen since Mr. Tyrer's table was published some two years ago; there it was given at 10d. per pound?—The import price may be 10d. now owing to there being no manufacturers in this country.

4505. (*Mr. Tyrer.*) It would appear that now, having learnt that the Finance Act does invite and specifically invite by sub-section 2 of section 8 those who desire to use a different kind of spirit to make application, and evidence having been presented that applications have been made and that the concessions granted under the Act have been found to be useful and workable. it only remains for you now to make the application?—Thank you very much.

Excise supervision under Finance Act, 1902.

4506. There is one point that I should like to refer to in that connection as you see it more now than you have done before; and that is the question of supervision. Dr. Thorpe and the Chairman have reminded you that it cannot be done without supervision—not the mere supervision which consists in the calling in of an officer just to see whether everything is going on all right as in the case of the use of ordinary methylated spirit, but a supervision which is of a character which protects you as well as protects the Revenue. What amount of supervision do you think that department of your business could stand? In some cases it has to be continuous supervision, and in other cases partial supervision; what could your business stand as a charge upon it do you think?—I think for a commencement it would have to be partial supervision, but as the thing grew then we might be able to take into consideration the question of entire supervision.

4507. Does it not occur to you that the beginning, when experience has to be gained, is the time, in the interests of both sides, when complete supervision should be had and not partial supervision?—If it were complete supervision for a short time at the commencement we might agree to that or be quite prepared to put up with it until we saw how the thing worked.

4508. What is your idea? Has the cost of supervision ever entered your mind? You know of course what business you do and what business you might do, and therefore it must have occurred to you that your business could bear under the competitive conditions of to-day probably a certain amount of expense; what do you think that would be?—It would be a difficult matter for me to tell you just at present.

4509. (*Chairman.*) What would you say to a hundred pounds per year? Supposing it were to amount to as much as that per year would that be a serious objection?—It would be rather a serious objection; there is no doubt about that.

4510. If it were half that it would be much less serious of course?—It would be so much the better.

Aniline oil suggested as denaturant for making dimethyl aniline. (*See also* Qs. 4476-8.)

4511. The amount of the supervision, speaking roughly, depends upon the extent to which you can, before using your spirit, render it unpotable; if, for instance, the addition of aniline oil would render the spirit sufficiently nauseous to make it quite certain that the workmen employed in the place would not drink it or carry it away. or anything of that kind, then the supervision would be very much less than if you were not able to do something of that kind?—The spirit that we should use for dimethyl aniline we could put the aniline oil into as soon as we got hold of it.

4512. Would that render it extremely nauseous?—Yes

4513. So that there would be no risk whatever of people drinking it?—There would be no possible risk of that.

4514. And therefore unless the aniline oil were taken out it would be perfectly safe?—Yes, but I am not going to say that it would be perfectly safe then; I do not think it would be if they could take the aniline oil out.

4515. (*Sir William Crookes.*) The aniline oil is very poisonous, is it not?—Yes, and I think it would be absolutely impossible to get the alcohol free from it.

4516. (*Chairman.*) In the case of your neighbour the charge is very small; it is not as much as £1 per week. Of

course it depends on the extent of your works, the amount of spirit consumed, and so on, but if you did not use a very large quantity and it was kept within a comparatively moderate space, I do not suppose it would come to very much ?—Thank you.

Protection of recovered spirit.

4517. (*Mr. Tyrer.*) Could you recover the spirit at all ?—Not from dimethyl aniline, but from some of the other processes we should have to recover it, but even then, when we recovered it, it would be so contaminated with the article we use it for that it would be impossible to drink it.

4518. Are you quite certain about that ?—I am sure about it.

4519. Would it be sufficiently contaminated as to render the use of locked receivers and locked stills unnecessary ?—I daresay it would be so contaminated that if anyone took it it would poison him straight off.

4520. Are you speaking now of the derivatives of the aniline ?—I am speaking of the distilled stuff.

4521. Assuming for the moment that in the early stages of acquiring experience the Revenue Authorities required that the stills after charging, should be locked, and that the receivers should be locked too, there would, I presume, be no objection to that ?—There would be no objection whatever. We should be only too pleased to have a man permanently with us for a while and let him see exactly how we put the stuff to it and everything that takes place in connection with it.

4522. That is to say, your attitude towards the concession would be to assist the Government in arriving at a sound conclusion as to not only the character of the manufacture but the safety of the Revenue ?—Decidedly so; we should be only too pleased to do that.

4523. It would be as much to your interest to protect the revenue, as it is the interest of the authorities that the Revenue should be on all grounds protected ?—Yes. We should make the stuff as soon as we get it into our works, so that it would be impossible for anyone to drink it.

4524. I am referring at the particular moment to the recovering of any amount of spirit which was over and above the amount necessary for the particular operations which, as you know, is often required; in your opinion the recovered spirit would be so contaminated as to be impotable ?—Yes, absolutely.

4525. And if there was a doubt on that point there would be no hindrance to your manufacture if the stills were put under sufficient security sanctioned by the Revenue ?—Not at all.

Dye-stuffs sent out in alcoholic solution. Methylated spirit used but in decreasing quantities.

4526. (*Dr. Thorpe.*) I see that you have been allowed to use two thousand gallons of methylated spirit, but that the amount of methylated spirit that you have been using has been steadily getting less and less now, and as a matter of fact, you only use about three hundred gallons in the year ?—Really the methylated spirit that we use is used for certain purposes, when it is evaporated entirely.

4527. May I ask why is your consumption of methylated spirit getting less and less ?—For this reason, that in days gone by, and even at the present time, we used to sell a good quantity of colours in spirit solution and we are gradually finding out that the price of it is knocking them out completely.

Necessity for Excise regulations to prevent use of duty free ethyl alcohol for this purpose.

4528. I suppose we may take it that your present use of methylated spirit really corresponds to your actual need of ethyl alcohol ?—I would not say that.

4529. Do you contemplate using the ethyl alcohol in processes in which you have not hitherto used it; is that your point ?—We should use both ethyl alcohol and methyl alcohol in processes that we have never touched in the last twenty years.

4530. I am not speaking for the moment of methyl alcohol, for the manufacture of dimethyl aniline ?—Yes.

4531. Di-ethyl aniline is used to a comparatively subordinate extent but you also want to use ethyl alcohol for certain other processes ?—Yes.

4532. Although for the present you do not use it ?—Yes.

4533. Do you contemplate using it as a solvent ?—No, only in some rare instances. Its use as a solvent would be a very small thing.

4534. Is it to go out from your works in that form as a solvent ?—No.

4535. If you sold spirit dyes in solutions would they go out as methylated spirit ?—They do not go out as methylated spirit.

4536. From time to time I understand that solutions of dyes in alcohol are required ?—Yes, they are, and those that go out consist perhaps of about 30 or 40 per cent of colour.

4537. That is, the colours go out in spirit solution ?—Yes.

4538. At present in a methylated spirit solution ?—Yes.

4539. Supposing that you got this concession to use pure ethyl alcohol, do you contemplate using that as a solvent for such dyes ?—No.

4540. Then how are we to be protected in that respect ?—That is a matter that I do not think would come into consideration, because the price of methylated spirits to-day and of the alcohol that we could get duty-free would not be very much different, and therefore the people are not likely to pay the price. At the same time if such a thing did happen of course that would be a matter that the man appointed by you would have to see to when he was there—he would have to look into the use that it was being put to.

4541. It is quite conceivable that we might devise methods for allowing you to use within your works alcohol which was partly consumed and partly recovered and used over and over again; but it would be quite another matter to give you facilities for allowing pure alcohol to go out of your works, would it not ?—We should never think of sending pure alcohol out of the works; in fact we should not ask for such a concession.

4542. Then side by side with your concession to use pure alcohol you would have still, to a moderate extent, to buy methylated spirit ?—Yes.

4543. But how are we to keep these things separate, because methylated spirit is more expensive than pure alcohol ?—You might keep them separate in this way: we could give you a return of the colours we sell in spirit, or you could have a return yourselves of the colours that are sold in spirit and go out in that condition.

4544. That is a point that would have to be considered; I think you can see that ?—That is a point of course that would apply to similar people to ourselves. You must have an account of the colours that are sent out in spirit. I say that, as far as we are concerned at present, that is a very small matter.

4545. But it might at any time become large ?—Yes, it might at any time I should say turn up; that is one of the things that might turn up. There is no doubt that if people can get a spirit colour at anything like the price that they can get one that has to be dissolved in water, in 50 per cent. of the cases they would prefer the spirit colour.

Advantages of dye-stuffs in alcoholic solution.

4546. (*Mr. Tyrer.*) Have you found any disadvantage in the use of methylated spirit for the lighter shades and delicate shades of colours ?—No, but the dyers do. The dyers prefer a spirit solution, for the simple reason that it holds the colour in solution and when they put it into the dye bath, as the alcohol evaporates the colour comes out gradually and goes very evenly on the fibre; whereas when they have it in a watery solution, it rushes on very quickly, and they do not get an even shade.

4547. What is the reason of that ?—The reason is that as the alcohol evaporates, the colour comes out gradually.

4548. (*Dr. Thorpe.*) The alcohol solution mixes at at once, does it not ?—Yes. Some of the colours are absolutely insoluble in the water, and as long as the alcohol remains in the water, it keeps the colour in solution, but as the alcohol evoparates, the colour gradually comes out and deposits on the fibre, and this gives a very even result.

Rhodamine (*See* Qs. 4428-30.)

4549. (*Mr. Tyrer.*) A little while ago you said that what had stimulated you recently was the expiration of the Rhodamine Patent ?—Yes.

4550. Did you follow the evidence upon that case some little time ago ?—Yes.

Mr. J. Turner.

10 Jan. 1905.

4551. Am I right in saying that one of the German experts who was over here, at some point in cross-examination, said that it would be impossible to make rhodamine dyes here unless cheap alcohol were employed?—Yes, that is absolutely correct; in fact I have it from their own lips. I was at the place where it was manufactured, and they told me so distinctly. They said "Now here you are going to make rhodamines;" I said, "Yes." We got on about the cost, and I said our cost was 9d. per lb. They said, "Our cost is 5d. without labour and we shall sell it at 9d., but you cannot produce it unless you get the alcohol duty-free."

4552. But with alcohol duty-free is it possible to make it at the price?—It is possible to make it then at 5d.

4553. Did they admit that with alcohol at the same price as they can get it at, you could make it?—We could make it then.

4554. And compete with them?—Yes.

4555. Therefore it would then be a case of cutting?—Yes. The stuff is sold now in England at a price at which it is impossible to make it with duty-paid alcohol.

Chemical training in England.

4556. If I may, I should like to ask you one question now about the character of the chemists. We have had some evidence on that subject. Are you able to find English chemists, or chemists trained in England, equal to the demands and requirements of your laboratory in this branch of organic work?—We are.

4557. English-trained chemists?—Yes. We have been up to this present year without a foreign chemist for five years, but at present we have two foreign chemists.

4558. I presume your English trained chemists were trained at the Yorkshire College?—Some of them were trained at the Yorkshire College and some of them in London. Some of them we have brought up ourselves and sent to college afterwards.

4559. Have you any knowledge personally of the chemists of the same grade that are employed in foreign factories? Have you seen any of them, and have you seen their work?—Yes, I have seen their work.

4560. Do you think they are superior to the English-trained men, or thereabouts?—I think by comparison that if our men had encouragement here like they have in Germany we would have better men than they have on the Continent.

4561. That is a big term, "encouragement;" what do you mean?—The restrictions on alcohol have been a very great detriment to our men here. As soon as we have touched anything that has contained alcohol, it has had to be dropped.

4562. Of course it is a short time in the history of research, but it is a fact nevertheless, is it not, that the very first concession made, and happily made, was in the direction of giving the Universities, Colleges, and approved institutions, alcohol for the purposes of research? That has only been done very recently; still you know of it., I suppose?—Yes.

4563. And have the results, so far as you can trace them, been beneficial?—Yes.

4563a. Do you agree with what Dr. Armstrong said, speaking of this concession of alcohol—that all research ultimately led to industrial application; broadly, that is true I suppose?—Broadly, that is true.

MR. ARTHUR ASHWORTH, called; and Examined.

Mr. A. Ashworth.

10 Jan. 1905.

4564. (*Chairman.*) Do you represent the Bury Chamber of Commerce?—Yes.

4565. That Chamber, I understand, is interested mainly in calico printing, dyeing and paper manufacture?—And also in the textile industries.

4566. Have you a business of your own?—Yes, I am a chemical manufacturer. I produce colouring matters that are employed by calico printers, dyers and paper makers of various types.

4567. Where are your works situated?—In Bury.

4568. Are you using alcohol to any extent now?—No, I am using none whatever.

Importance of alcohol in modern colour industry.

4569. Not even methylated alcohol?—Not even methylated alcohol. I have only been in business myself a matter of fifteen years. Prior to my starting in business, methylated alcohol was employed for dissolving many of the colours that were produced at that period; but since then changes have taken place in the production of colouring matters, and a large class of colouring matters has arisen in the dissolving of which there is no necessity to use alcohol. But the necessity exists to a greater degree at the present time for the use of alcohol in the direction of what you may term the modern colouring matters, that is, those colouring matters which have been evolved by discovery subsequent to the period when the alcohol was used for dissolving them.

Finance Act, 1902. Permission to use duty-free spirit for making ethyl chloride refused.

4570. At this moment should you be glad to use alcohol?—I should be very glad indeed to have the opportunity to employ alcohol. It is a very essential thing in regard to the production of the colouring matters that are enormously employed at the present time in this country, and we are at a very great disadvantage as regards the competition with continental manufacturers in that respect.

4571. Are you acquainted with the provisions of the Act of 1902?—I have made two applications for the use of alcohol under that Act, but they have both been refused, the Board stating at the time that they did not think the thing was of sufficient importance to permit me to use it. What clause of the Act are you referring to?

4572. Section 8 of the Act of 1902. What were the particular purposes for which you applied to be allowed to use alcohol?—Twelve months ago I applied for permission to use alcohol in the production of ethyl chloride. In my application I mentioned that I desired it primarily for some pharmaceutical compounds, but in my mind's eye at that time I had its further use as an esterification agent for colouring matters, the patents of which were held by one of the powerful German corporations. Owing to the Patent Laws having been altered, we presumed that it would be possible to compel these people to grant a compulsory license. I found that even if I got this compulsory license I should not have been able to produce the colouring matter without the use of alcohol in order to produce first, the ethyl chloride. I think in the *precis* of evidence that was sent in to the Secretary, it is mentioned that a member of the Bury Chamber had made an application for the use of alcohol and that it had been refused. I am that member who was refused. Possibly Dr. Thorpe will remember me coming, not only in regard to that matter but in regard to another.

4573. (*Dr. Thorpe.*) I remember your calling upon us with respect to the manufacture of saccharin; did you at the same time as that make your application with respect to ethyl chloride?—It had been made previous to that, and I came down on two or three occasions. The application that I made had to be made through the local Supervisor. I wrote, at any rate, to the Department first, and they stated that the mode of procedure was to apply to the local Supervisor, so I made the application through him. It was refused in the first case, and then I wrote stating that possibly the refusal had been made on account of the Board not being able to understand the object of the application. I came up and saw Mr. Leah on two or three occasions, and Mr. Leah sent me across to see Dr. Thorpe, but he told me, when the saccharin question was on, that the matter had been before the Department on two or three occasions, and they had finally decided not to grant such an application.

Rhodamine. Manufacture in this country not practicable without cheaper alcohol.

4574–8. (*Chairman.*) What was the particular colouring matter in the manufacture of which you intended to use the ethyl chloride?—Rhodamine. Without permission to use duty-free spirit I could not obtain alcohol at such a price that we would be able to compete. The cost of production, on the price of alcohol that we would have had to pay otherwise, would have been infinitely higher than the price at which the colouring matter is being sold in this country; whereas if we had been able to obtain the

alcohol at a similar price to that at which the Germans can get it, we might have produced the colouring matter at a similar cost to that at which they produce it, and we could have sold in competition with them. We have in Lancashire one house, or at any rate one association that consumes 50,000 lbs. per annum of this single colouring matter alone.

Prices in England and abroad compared.

4579. (*Mr. Tyrer*). At what price per pound?—It is a matter of 5s. per pound and the cost of production has been estimated at from 1s. to 1s. 1d. That self-same colouring matter is sold in Belgium, Spain, Austria and Italy, at 1s. 9d. or 1s. 10d. up to 2s. per pound.

4580. Why?—Simply because there are no patents in those countries, and the German patent holders have not considered that the industry would be of sufficient importance in those countries for them to manufacture it on the spot. They are compelled to manufacture in France, and they are also compelled to manufacture in Austria in order to maintain patents; but they have not considered it necessary there. The result is, that on account of meeting other competition, they sell in those countries at a considerably less price than what they sell at here. You can easily see the disadvantage to which our calico printers and dyers are subjected when they are competing with those countries, on account of this difference in price.

4581. (*Chairman*). I do not know whether you are acquainted with the Table II, attached to the paper read by Mr, Tyrer before the Society of Chemical Industry (see Journal of the Society of Chemical Industry, 15th March, 1904, No. 5, Volume xxiii, page 227.) That shows the quantity of alcohol used per £100 import value in, among other things, Rhodamine B, Rhodamine G and Rhodamine 6 G. Is it one of those colours that you are referring to?—I was referring to all of the rhodamine series, and more particularly 6 G.

4582. In two of them, Rhodamine B and Rhodamine G, the amount of alcohol in one pound of the finished product is something very small. Take for instance Rhodamine B; even if you had had to pay the duty on the alcohol, according to this table it would only have added 4 per cent. to the cost of the production?—That appears so.

4583. If you are going to make 200 or 300 per cent. profit on the article that additional cost of itself could not have been a very fatal objection?—As regards Rhodamine B, the patent on that has already expired, and the selling price at the present time is a matter of only 1s. 2d. or 1s 3d. per pound. Then on account of the gigantic depreciation fund which these big works have established on the Continent, if they so desire they can reduce the price to any amount so as to make it absolutely impossible for us to live, even if we were to enter into competition with them. The most remarkable instance was the parallel case of the alizarin industry.

Alizarin. Control of prices by combination of German manufacturers.

4584. Alcohol does not enter into that at all, does it?—No, it does not. You will probably be aware that the industrial process was first discovered by Perkin, and almost simultaneously by the German chemists, Graebe and Lieberman. The industry was established in this country and run successfully before the German manufacturers got their works going. Subsequent patents were taken out with the result—on account of their being no compulsion in this country to work those patents—that English manufacturers were not able to take advantage of later discoveries, or if they were it was through arrangement. It ultimately came to this, that the only house producing alizarin in this country were the successors of Perkin. Before the general patents fell in—I believe that was in the year 1883—the combination of alizarin manufacturers on the Continent advanced the price to 2s. 6d per lb., I believe, for the twelve months before the expiration of the patents. We had in this country two houses who were producing the raw materials; they were Hardman and Holden, of Manchester, and Sadlers of Middlesbro'. They put up plant for the production of alizarin, and the moment that they put the product upon the market the German manufacturers reduced their price down to 10d. per lb. The competition went on for a matter of two or three years until the price was reduced to 5d., and the Germans drove Hardman and Holden and Sadlers out of the trade. Since then the price has been advanced up to 7d., 7½d. and 8d. A couple of years ago Sadlers advertised in the American journals, and I communicated with them, because I employ a very large quantity of alizarin myself, and am desirous of getting it in the cheapest market, and prefer to get it here if I can. They advertised that they intended to make alizarin again, but they stated at the time I communicated with them that the plant was not ready. I knew their agents in America, and so I asked their American agents whether they were offering it in the American market. They stated that they were, but that it was only a very small quantity indeed. Then I got a letter from the American agents afterwards, stating that they had ceased to offer alizarin, as Messrs. Sadlers had withdrawn the article from the market. It was a current rumour at the time that the reason why they did that was that the German manufacturers had threatened that they would reduce the price again to such a point that it would be impossible for Sadlers to continue working. It seems to me that there is a possibility in all these things of their doing likewise. You see the whole of the big houses, four in number, have combined at the present time, and as they have free alcohol for production of raw materials of course if they so desire they can run us out of the market. I do not doubt myself but what there is sufficient inventive genius in this country, and that the knowledge requisite does also exist in the country to enable us in the future, if we have the self-same raw materials that they have, to introduce new products. They are constantly being discovered, and I do not see why England should not at some period or other occupy the self-same position as she did years ago of being able to produce new products, provided of course we have the self-same materials to work with that the Continental manufacturers have. If we have not, then I do not know what the ultimate result will be.

Commanding position of Germany admitted to be due to other causes besides alcohol. But free alcohol would be of assistance in resisting German control of prices.

4585. What you have been saying now indicates that there are a great many other considerations besides the alcohol question in connection with these colours?—Yes, and I have mentioned that to show you the reason. I am a man who desires to see the industry, so far as I am concerned, doing whatever it possibly can. I have had to build it up with a good deal of hard work. It is a matter of fifteen years since I started in business, and I have always had an ambition to get into the higher branches of it. It is there where ultimately the money is made if money is to be made; and not only that, but it is there where the industry, as an industry, will have to secure its future if it is to be established on the large scale that it is established on the Continent. We have been labouring under most arduous conditions, and I hope at any rate that the result of this Committee will be the issue of such regulations that it will be possible for any industry to be established that requires alcohol; and I hope that especially as regards the colour industry, because it is a most important one on account of the enormous textile industries that we have in the north.

4586. What you have said about the alizarin colouring matters does seem to show that the position of the Germans in this particular industry, from whatever cause, has become so powerful that, quite apart from the question of alcohol it is a very great question whether it would be worth anybody else's while to embark much capital in an attempt to fight that huge combination?—Of course there is that consideration, but still at the same time we should like to have the opportunity. There are at the present time, not only in France but also in Germany and also in Switzerland, manufacturers, at any rate the smaller manufacturers, who can see—or believe, for I will not say they can see; it is a matter of belief—that the trend of events as regards the big combinations there, is that they will be forced out of the trade. There are many small concerns who are prepared to ally themselves with people who are connected with the industry in this country, but the firms with whom I have discussed the matter have always said to me, "You cannot do anything in England until you get free alcohol." I know that in 1895 a house were prepared to bring, or at any rate to send a portion of their plant across to this country, believing—but it is not a question of belief; it is a question of actual demonstration—that if we could have had alcohol they would have been able to produce it at a considerably less cost in this country than they were doing on the Continent. The product that I have in my mind—it was gallocyanine—is a product which comes to this country in a paste form, and there is a heavy carriage upon it. They would have been able to

Mr. A. Ashworth.

10 Jan. 1905.

produce it here at less than what they were producing it on the Continent, and there would have been a saving in regard to the carriage and other things. They were prepared to come, but it was impossible to do anything on account of our not being able to obtain alcohol.

4587. Let us take those rhodamine colours in which you are particularly interested, and let us assume that all the patents are expired (some have and others are expiring apparently), and let us also assume that you are proposing to manufacture these colours in this country and to employ alcohol—of course under arrangements which will make it duty-free to you, but at the same time under such conditions as will protect the Revenue. Do you conceive that a small difference in the price of alcohol, quite apart from the duty, such a difference for instance as 6d. per bulk gallon, would make a material difference? —Yes, undoubtedly. There is a question of a loss in the operations, because some of it would not be recoverable on account of the leakages.

Alcohol at same price as in Germany regarded as essential to success of British Colour Industry. (*See* also Q. 4654-63). Desirability of removing artificial obstacles to use of alcohol.

4588. Is the quantity of alcohol that you would use and consume for these colours so great that a difference of 6d. per bulk gallon on strong spirit would make a material difference?—Undoubtedly.

4589. Then, in fact, quite apart from any questions of duty or Excise regulations and so on, what you really want in order to start this industry in this country with a fair chance of competing with the Germans, is that you should be able at all times to buy your alcohol at a price not greater than your German competitor pays?—We want to get it practically at the self-same price. There might possibly be some slight amount required in order to pay for the cost of the administration, and that sort of thing. I am not speaking personally, of course, but it depends on the competition that we should meet with. I cannot give you any idea of that, but I do not believe that we could afford to pay any more than what the Germans can, and I do not see any reason why we should.

4590. That is another thing. You may say that in Germany both the production and the distribution of alcohol are so controlled either by the Government or by the trade that it is possible—and is in fact done—that alcohol used for industrial purposes should be sold at an abnormally cheap price?—That is so.

4591. Nothing that we can do in this country, short of imitating that which is not at all in accordance with our usual proceedings in this country, would enable us to overcome that initial difficulty of the fact that alcohol is unduly cheapened for industrial purposes now in Germany?—It seems to me that what has to be taken into consideration is the importance of the industry itself, not as it exists as present, but having regard to the possible developments of it.

4592. While it would, no doubt, be most desirable that all artificial obstacles in the way of the use of alcohol should be removed, still, if even that will not do, and if in order to give any hope of establishing successfully the business in this country, you must go further and remove not only artificial obstacles, but create artificial privileges, then there is not the same hope for this particular trade here, is there?—I do not know what you may term the natural difficulties which would prevent our having the alcohol just as cheap as they have it on the Continent.

4593. As I say, the distribution is controlled, and even the production is controlled in such a way that alcohol for industrial purposes is sold considerably below the cost price in Germany. Unless we can do that here, there is not much chance of beating the Germans in this particular field, is there?—Are our manufacturers permitted to produce the greatest quantity of alcohol that they possibly can with their plant? Are our distillers limited? Do the Germans and the French not run their alcohol production upon purely business lines?

4594. That is exactly what I do not think they do, but that we shall perhaps know more about another time. For the moment, at any rate, what we have got to consider is the removal of any unnecessary obstacles to the use of alcohol in this country, and for that purpose you want to be allowed to use alcohol duty-free in some other form than the methylated spirit form?—Yes, certainly.

4595. (*Mr. Tyrer.*) Gallocyanine only requires methyl alcohol?—Yes.

4596. But the rhodamines require ethyl alcohol?—Yes. You are right in saying that.

4597. In regard to the estimate of the cost do you notice the details that are given in the summary table in my paper; in every case there is an acknowledgment of the amount of material returned?—That has always to be taken into consideration. I have visited many of the works on the Continent, and I have asked specifically as to what the restrictions placed by the Government were, and whether they were of such a character as to be onerous to manufacturers, and they said not. Whatever system is established on the Continent for the regulation of it I do not see but what it might be applied here. *See* Q. 4581.

Excise restrictions abroad.

4598. Did such regulations as you saw appear to you easy to comply with?—Yes. In regard to the two concerns near Paris, as they explained it to me, the spirit comes principally in bond in large tank wagons on the railway practically under seal; then it is placed into a reservoir and sealed again, and a correct account is taken of the various operations that are employed, and the quantity of spirit taken. Of course, it is to the interest of the manufacturers themselves to see that nothing goes wrong as regards the men with regard to the drinking of it, because for one thing the men are rendered incapable.

France.

4599. Where considerable quantities are used such as you have mentioned, was there a resident inspecting officer?—No, the works were visited daily.

4600. Then the tanks were not locked?—The tanks were under seal.

4601. But how about the outlet?—After the spirit gets into the works and is put into their own tank, then they have the control of it absolutely, but must give a detailed account of the whole of the spirit that has been taken away; of course they like to see to that for themselves for their own protection.

4602. What is done with the recovered spirit?—The recovered spirit is returned to a separate receptacle. Then the stock is taken, and they are allowed, in order to keep the two together, that is to say so that they will not be using one more than another, to have a sufficient space to receive the recovered spirit. They take a note of the quantity of recovered spirit employed, and also of the quantity of fresh spirit, and the whole of it is traced through the operation.

4603. Did you observe that the stills or auto-claves were locked with the official seal, or with the seal which is semi-official in the sense of its being put on for them by the proprietors of the works, and whether the receiver for the recovered spirit also had similar precautions taken either subject to the Excise or for the protection of the proprietors themselves?—No, I did not observe that at all.

4604. You have just been speaking of France; can you tell us whether that is the case also in German works; was the practice similar there?—I could not really say what the German practice is now. I have been given to understand that it is similar in regard to the German works that I have been through from people that I have been working with on one or two matters when I have been over there. I did not visit the part where the spirit was principally employed. I should be able to obtain, if you desire it, a complete account of the manner in which they protect the spirit, and of the whole *modus operandi*.

Germany.

4605. (*Chairman.*) What was the factory that you visited in France?—It was the factory of Brigonet Père et Fils. They are large manufacturers of dimethyl aniline and also of pharmaceutical compounds. They also make a new product which they term Tallianine, which is a terpane with ten per cent. of ozone in solution, which is being employed extensively by veterinary surgeons as a curative for pneumonia. They employ a very large quantity of spirit. I have also been through Poirier's at St. Denis. I have been through three of the large Swiss works also.

4606. (*Dr. Thorpe.*) Chemical works?—Colour works.

Switzerland.

4607. (*Mr. Tyrer.*) Were the restrictions there rather similar to those you found in France ?—They were similar in character. I was not aware at the time that I should ever be called upon to answer questions of this character, or else I should have prepared myself for them. They gave me to understand in every case where I asked the question that the restrictions were of such character a that they did not interfere at all with the industry.

4608. But they were complete ?—Yes, they were complete.

4609. Of course, it is obvious that what might be considered supervision there might not be considered supervision here ?—Certainly.

4610. In consequence of the enormous difference in the duty ?—Yes.

4611. Nevertheless there was supervision and control ?—Yes, So far as I am given to understand it is sufficiently complete. They estimate the amount used in the different processes and they know the average amount of loss in the various operations.

4612. That has nothing whatever to do with the price ?—No, but they have to know the amount so as to be able to show what has become of the quantity of spirit that has entered their works. If there is any difference in comparison with the average loss they have to give an explanation of it. They know themselves that there must be a leakage as regards their method of manufacture, and they have to give a satisfactory explanation to the Government of what has become of the spirit.

German colour works. Development in direction of pharmaceutical and photographic products.

4613. Have you ever had an opportunity of visiting any of the establishments in Elberfield for instance ?—Yes, but I have not been in the spirit department there. I went through Ludwigshaven years ago.

4614. When one speaks of Elberfield one naturally think of Bayers ?—Yes.

4615. Of course they use a considerable quantity of spirit ?—Yes, they use a very large quantity, indeed.

4616. There is another colour works there, is there not—a small colour works ?—Yes, there is Dahl and Co.; and then there was a firm of Neuhaus who formerly manufactured colours and also alizarin, but they have been absorbed by Bayers or the Convention that existed as regard alizarin.

4617. Is there not another firm there which makes artificial silk ?—Yes, but I could not give you the name of it now; I only know that artificial silk is produced. Whether the process is a process which is dependent in a measure on alcohol I could not say; but I think the process for the production of what is termed artificial silk is in one place dependent on copper salts acting on cellulose.

4618. I suppose you know or have heard that in the case of the Badische Anilin und Soda Fabrik, Meister Lucius, and Bayers a very large proportion of the high dividends that they pay are due to their pharmaceutical departments ?—In a measure I believe so.

4619. And that is more the case now than it was ?—Yes; but we may take it that up to within the last year or two practically the whole of their profits have been made from colouring matters alone.

4620. Indeed; up to so recently as that ?—Well, perhaps up to the last five years.

4621. Up to the last five years ?—I am speaking more particularly as regards the Badische Company. The companies that have paid more attention to the pharmaceutical compounds are Bayers and Meister Lucius.

4622. And have their dividends rather increased than otherwise ?—Their dividends have increased, but they have never, I think, been equal to those earned by the Badische Company. The other German house, as regards fine chemicals, is the Aktiengesellschaft, of Berlin, and they have given more attention to photographic compounds. That has been their speciality, and I do not think they have given much attention to pharmaceutical compounds.

4623. Do you think that the development of the pharmaceutical side, to which so much importance has been attached, has been due to the fact that they have carried on research in colouring matters ?—Yes.

4624. Has it arisen directly out of that ?—It has arisen directly out of that.

4625. That is, it has arisen directly out of the research work connected with colouring matters ?—Yes.

4626. Would you say associated also with facilities for trying physiological and therapeutical experiments which we have not here ?—Yes; undoubtedly, and also because they have raw materials that we are not permitted to use here—I refer more especially to the question of alcohol.

4627. One always wants to have a sense of proportion in these things. Does the alcohol question in regard to pharmaceutical preparations bear the enormous relation of importance which it is supposed popularly—of course within rather a narrow circle; that is understood—to bear ?—It is difficult to say really what the production is. I believe, as regards the profits made from it, it had had a very important influence on the two large German houses—Bayers and Lucius.

4628. You mean the cheap alcohol has ?—Yes; but the pharmaceutical products that they have produced have had a very important influence on the profits that they are making.

4629. The point I put to you is whether the importance of alcohol in relation to colours on the one hand, and to pharmaceutical preparations on the other, has been overstated ?—No, I do not think so.

4630. You really do not ?—I do not indeed. There are many of the pharmaceutical compounds that require alcohol of which there is a growing consumption and for which this country is certainly a very big market. Take one, vanillin. There are two or three processes for making it. One company is working a secret process in which I believe they do not employ alcohol, but in the known processes I believe that alcohol is employed in every case.

Rhodamine (*See ante* Qs. 4581–2.)

4631. The Chairman has drawn your attention to Mr. Leuthardt-Thornton's table, which I quoted in my paper, and has epecially referred to the relatively small alcohol cost of rhodamine B. The percentage cost is enormously increased, is it not, if the price is cheap ? Now, I think you said the price is 5s., but if it goes down to a competitive price of something like 1s. 6d. or 1s. 9d., then of course the percentage cost of the alcohol required will be relatively increased ?—Yes.

4632. Therefore the importance, having regard to these competitive prices of cheap alcohol ?—Yes, certainly. The prices you have quoted in this table are considerably larger than they are now, I fancy, although they, no doubt, were true at that period.

4633. That table is practically about two years old; have you seen it before ?—I have never seen this table until now.

4634. I may remind you that it appeared in the paper which I read in 1904. Without binding you to any definite opinion, what do you think the prices there for alcohol per £100 worth ?—I have had no experience in the production of these rhodamines.

4635. I admit it is a difficult question to answer ?—Yes, it is. I could not answer a question of that description.

4636. Could you take some of those that you have experimented upon and do know about ?—I do not know whether I dare tell you that we have experimented. At the present time if we make any original research and if we use methylated spirit and then distil it off, we are, I suppose, committing an illicit act in performing that operation ?

4637. May I ask this question, which I have never asked before, because it has never occurred to me before ? Was Mr. P. Leuthardt-Thornton—the gentleman whose name is at the top of the table, and who is responsible for these figures—a gentleman who gave evidence in some case, either yourself, or Thompson *v.* the Badische, or the Badische *v.* Thompson ?—I do not know, I am sure.

4638. I thought you were interested in that matter ?—Only as regards the license.

Antipyrine and phenacetin.

4639. Do you think that such products as phenacetin and antipyrine could be produced here at competitive prices ? I think you know that patents are out in the

Mr. A. Ashworth.

10 Jan. 1905.

one case, and that there is no patent in the other ?—I know that.

Cost of alcohol one of the reasons for non-manufacture in this country.

4640. There may be other reasons, but is it not the fact that one considerable reason why they have not been produced here has been the price of alcohol ?—Yes, that undoubtedly is the case. We cannot produce it here with the present price of alcohol. When the patent of antipyrine fell in I was in communication with one of the French houses in regard to it, but we found that it could not be produced here at all. There is a very large market for it here, because through this country there passes a large quantity of the antipyrine that is sent to our colonies.

4641. Did you ever consider the manufacture of sulphonal ?—No.

4642. Nor of chloral ?—No.

4643. Of none of these pharmaceutical products ?—No. It has been a question of this description, that we have had to be content with the crumbs that we could pick up outside of alcohol, and that in any original research we made the moment we have run up against alcohol we have had to leave it altogether on one side.

Cost of alcohol, its restrictive effect on the development of new processes.

4644. Supposing that to-morrow you had alcohol relatively cheap, if not absolutely cheap, are the resources of the English laboratories enough to compete—with a little practice, of course, and experience—with the foreign laboratories; that is to say, are the English chemists able to do so ?—No, not at the present time, but I still think that the principal reason of that is on account of not having the material for them to work upon in the past. I have at the present time a product which we cannot touch, because the only way we can get this thing condensed is through alcohol. It is colouring matter that would substitute an important anthracene colour. If we were permitted to employ the alcohol at a similar price to that which is paid on the Continent, we should be able to produce it and to compete, but we cannot.

4645. Taking things within the region of probability, of course, it is possible to have alcohol, as we know it is to-day, which can be made cheaper here; but when you are calculating the cost of raw material before you begin to set up your plant or to think about it, at what price should alcohol be—of course, I know the answer would be, at exactly the same price—in order to enable you to compete with the foreigners ?—I am not in a position to answer that question, on account of not having made any practical experiments. Of course, as you know, such experiments are essential before we could obtain data to know what the yields and the losses in the intermittent processes were. We have based our calculations upon the assumption that the alcohol can be obtained at the price that it can be obtained at upon the Continent, and upon the further assumption that we would have an advantage in employing two different raw materials that have not been used for the purpose before. The colour I am referring to is anthracene brown. There is a very large consumption of it. It is a condensation product between benzoic acid and gallic acid. We have found a method at any rate of producing a colouring matter which is equally fast against light and milling, but we cannot condense the materials we have except with the aid of alcohol. We have tried every other material, but the results are inferior, and so we have not been able to put it upon the market.

4646. Have you patented your process ?—It has not been patented. We have made a provisional application for it, but on account of the difficulty ultimately arising in connection with the alcohol there has been no publication.

4647. (*Dr. Thorpe.*) Is methylated spirit unsuitable or detrimental in that manufacture ?—In that colour I do not know that it would be, but of course there is the question of the recovery. We always get better results from recovered alcohol than we do from the methylated spirit. On account of the gummy matter from the acetone it has a tendency to diminish, especially with the delicate shades, the lustre of the colouring matter; but it would not have any influence as regards the alteration of the molecule.

4648. Why did you not go on with it ?—Because we could not get the spirit.

4649. I understood you to say that after your first difficulty was got over the methylated spirit was not unsuitable or detrimental and that the recovered spirit would suit you ?—Certainly, but the price that we would have to pay for the methylated spirit took away the advantages that we had in the other raw materials. If we had been able to have alcohol at a price which would compare favourably with the price on the Continent we should have been able to develop an important business in it.

4650. You cannot hope to get the alcohol, supposing you had it duty free, at less than the natural price of alcohol, can you ?—The question arises again, what is the natural price of alcohol.

4651. The natural price of alcohol I suppose you may say is in the methylated spirit plus the cost of methylation, whatever that may be ?—But there is a difference at any rate between France, Germany, and Switzerland, where they not only produce but consume the alcohol at a much less price than what we have it at here. Whatever the difference is there it is, and of course it is not for me to decide as to whether it should be or should not. I ask myself the question why is it not as cheap here ? We are a free-trade country where we can introduce any description of amylaceous products from any part of the world, and I do not see why those products should not be employed here, for the production of alcohol, even though we have not the quantity of land under cultivation that the French and Germans have.

4652. That is the whole point. As a matter of fact alcohol in Germany is produced at a higher cost than it is here, though it is perfectly true that industrial alcohol is used at a price below its natural cost of production ?—That raises the same question again.

4653. (*Mr. Nicholson.*) An expensive amylaceous substance is used as a matter of fact in Germany and not the cheapest amylaceous substance ?—That is a matter that I am not conversant with.

Alcohol at German price necessary for successful competition in this country. (*See also* Qs. 4587–94.)

4654. (*Chairman.*) From your point of view that is really the important thing for us to know. Do you hold that unless we in this country can get the spirit at the same price that the German competing industry gets it at, we should not be able commercially to compete against them ?—I do not see how we can. Of course, there are other phases, for instance there are questions of carriage and questions of package. It may be possible to move certain materials and deliver them into the hands of the consumer packed under different conditions to what they are at the present time; and being near to our home market we might have advantages which would permit us possibly under some conditions to pay a small increase over the price that it costs for alcohol in Germany, that is to say, if the alcohol is actually sold there at a less price than what it is produced at.

4655. (*Dr. Thorpe.*) Do you not know that that is the fact ?—No, I do not indeed.

State-aided spirit in Germany.

4656. You are not aware then that the German manufacturer, on account of the various rebates and the method of taxation, practically gets his alcohol at less than cost price ?—No, I am not, but I have seen it stated that the alcohol distillers in this country are not permitted to work their places to the maximum extent and consequently the cost of alcohol is considerably higher than what it would be if they were permitted to put in the most modern plant and work it to the maximum.

4657. (*Chairman*). That is true so far as it goes, but it does not go to the length of the difference between the German and the English prices ?—Of course I do not know about that.

4658. *Mr. Nicholson*) It is quite true that the distiller in this country produces alcohol under restrictions which slightly enhance the cost, but that does not affect the question of the cost of the spirit in Germany, the selling price of which for industrial purposes is a great deal below cost price ?—Then I suppose the self-same thing must exist in France. The French price is actually lower than the German price, or it was some time ago.

4659. Then undoubtedly that must be so ?—What part of the community suffers for that ?

4460. The consumer ?—Then the consumer should suffer here.

4661. When I say the consumer I mean the drinker ?—I think we have already a certain amount of whisky money put on one side in order to educate the people, but it is no use educating them unless when they are educated you can find something for them to do. Why not put a little more on the whisky and let it be given as a rebate for the use of alcohol as they do on the Continent ?

4662. Do you suggest that alcohol for industrial purposes should be State-aided ?—Do you term that State-aiding ?

4663. Certainly it is State-aiding if you are to be allowed to buy it below the cost of production ?—Then I say yes. certainly. Or permission might be given to distillers to produce alcohol with the minimum restrictions essential for its cheap production for industrial purposes, seeing that it is possible to obtain here, as admitted by Mr. Nicholson, cheaper amylaceous materials than are employed on the Continent.

German spirit prices (1891 to 1904).

4664. (*Mr. Tyrer.*) I have received a letter from Mr. Hugo Lorenz which gives the average price of spirits of wine in Germany during the last ten years and adds, "If you deduct from same 16 marks for the mash tax and 6 marks for the Brennsteuer (distilling tax), together 22 marks, you will get practically to the export prices, which, divided by three, would give you about the price in pence per proof gallon. The prices of S.V.R. since December, 1890, fluctuated as follows: " In 1900 this price is put down at 19 marks per hectolitre; in 1901 the lowest is 15 marks and the highest 18·25 marks; in 1902 the lowest is 12 marks and the highest 15 marks; in 1903 the lowest was 15·50 marks and the highest 29 marks, and in 1904 the lowest was 30 marks and the highest 32 marks. Then Mr. Hugo Lorenz gives me the range from 1891-2 to 1900-1 beginning with 38·60 marks and ending with 39 marks, the total for the ten years being 385·41 marks, and the yearly average 38·541 marks. This is made up, as you know, by the surpluses which I have just quoted, which are taken off for industrial purposes, and therefore there is a very direct indirect method of State-aiding industrial alcohol, and the difficulties it gives rise to here one need not enlarge upon because they are obvious ?—Yes, they are.

Fine chemicals, requiring no alcohol, in many instances produced cheaper in Germany than in England. (*See also* Qs. 4681-5.)

4665. (*Dr. Thorpe.*) Perhaps you will be able to tell me this. Are there not really a good many of the so-called fine chemicals made in Germany which can be produced at a cheaper rate than we apparently are able to produce them, in which no alcohol whatever enters ?—Yes, there are.

4666. What are the natural advantages which the German has over us in the production of those things ?—Many of these products are being produced at works where they are actually producing other pharmaceutical compounds which require alcohol, and they run practically together.

4667. But there are large quantities, are there not, of these so-called fine chemicals which come to this country which we do not make here, in which alcohol is not concerned, and in the manufacture of which we cannot apparently compete with the Germans, or do not compete with them ?—But, as I say, they run together. I was not prepared for a question of this description, but I believe that the pharmaceutical compounds and fine chemicals of which you are speaking are already produced in works that employ alcohol for other products and that the two processes, being in a sense similar, are run together under one adminstration. They can work cheaper under those conditions than we should be able to work if we had to take the few materials that we could produce without the advantage of being able to produce the other materials requiring alcohol.

4668. Do you mean to say therefore that the one thing is made to pay for the other; is that what you would imply ?—Undoubtedly they run together—not as regards one being made to pay for the other, but the cost of the administration is spread over the two. The laboratories are all under one roof as it were, and the administrative cost is divided up over a variety of products instead of being charged to two or three.

4669. I can give you half a dozen illustrations in Germany where no alcoholic product at all is made, or where no sensible quantity of alcohol more than would be used incidentally in a laboratory is employed, where a large quantity of fine chemicals is turned out, many of which find their way into this country. Why cannot we do the same ?—That is a phase of the chemical industry which I have not studied at all. I have been connected with the textile industries, not only cotton but wool, and have made a study of the various products that they require, and of course I can speak there with a greater amount of knowledge. Whatever the reason may be as regards fine chemicals as illustrated by your remarks I cannot say.

4670. You do not know ?—I do not know.

4671. Obviously there must be some other cause than alcohol at the back of it all whereby the Germans are able to beat us in the preparation ?—Yes.

4672. There must be some cause at work why Germans are able to beat us in the manufacture of a large group of chemical substances which are classed as fine chemicals ? —Yes.

German pre-eminence in chemical industries. Education the primary factor. But it is urged that advantages in regard to alcohol have contributed to it.

4673. Many of those are organic, indeed they are mostly organic; what is the reason of that ?—Undoubtedly their system of technical education has been superior to to ours for many years.

4674. It is a question of education is it not ?—It is a question of education. Undoubtedly that has an enormous influence. Of course the whole question is somewhat complicated and it requires a good deal of sifting and conscientious study.

4675. Primarily and at the base is it not the system of education which is at the bottom of the pre-eminence of Germany in chemical manufacture as a whole; is that not the real factor ?—Primarily, yes, but there are many conditions that have helped and that have compelled them as it were to develop their system of education to the extent that they have done. Take for instance the discovery of alizarin.

4676. You said that that, I think, was made by Perkin here; you will pardon me but it was Graebe and Liebermann who discovered the mode of synthesis of artificial alizarin ?—I believe at any rate there was only a matter of three or four days between the times of the application for their patents and that Perkin's was simultaneous.

4677. I know all about the facts. Graebe and Liebermann were the first to make artificial alizarin. It is perfectly true that Perkin came along afterwards with another practical method, but the idea, the mode of manufacture of the thing as a product, apart from any technical application—because they had not any idea of its technical application at that time—sprang from Graebe and Liebermann. They discovered it as a purely scientific product, and the idea of its subsequent application was quite foreign to them at the time. It is perfectly true that when the comparative ease with which the thing could be obtained dawned upon them they, as sensible men, protected whatever pecuniary interests there might be in it, but it was some time subsequent to that before Perkin devised a manufacturing process, when the knowledge of it was known to the world ?—I have been given to understand—but I am not going to take an oath on it—by people who ought to know, that there was only a difference of three or four days between the applications by Perkin and Graebe and Liebermann.

4678. That may be true, but it was a notorious fact in Germany. I was in Heidelberg at the time, and I know perfectly well what a sensation it created all over Germany when in 1868 alizarin, a pre-eminently typical member of an organic vegetable colouring matter, was launched upon the world. The effect was perfectly electric, and many people set themselves to work to discover how to turn it to practical account. But let the credit be given where it is due. The actual synthesis, the actual conception of the idea did emanate from those two chemists whom I have named ?—Of course I do not know, but I can say that on account of the success they have been able to make out of that industry they have seen the possibilities of organic chemistry, and of course they have pushed it to the utmost;

Mr. A. Ashworth.
10 Jan. 1905.

and in the various stages through which it has passed it has been found essential to employ products and materials that we have not or that have not been permitted to us under conditions similar to theirs.

4679. Of course we lay that flattering unction to our souls. The first time I went to Ludwigshaven I went through the Badische Anilin und Soda Fabrik and when after that I went to Munich and saw Professor von Baeyer, whose name you know of course, and told him of the extraordinary impression which the spectacle of that works had made upon me, he said—and this illustrates what I mean when I say it is education—"Do you know to whom we owe all this?" and I said, "Yes, I do, Liebig." "You are right," he said, "it is to Liebig that we owe all this." That is what I mean when I say it is education?—Undoubtedly that has been one of the principal factors. Still at the same time we are attempting in this country to do what we possibly can in order to overcome the disadvantages under which we have been labouring, and I do not think that we shall make any progress as regards this industry until we have the self-same liberty and the self-same materials that they have elsewhere. Are there any Englishmen or any Britishers who have done anything at all in regard to the delicate problems of organic chemistry that have turned out an industrial success? Are there any of them who have done anything towards the synthesis or synthetical development of any products that have turned out a commercial success?

4680. Not to the same extent as in Germany, and for this reason that there has been no man in our chemical schools in England who has exercised the same influence upon public opinion and upon the modes of teaching in our schools as Liebig did in Germany. We had Hofmann, who was a pupil of Liebig, and when he became famous the Germans took him back again?—I cannot of course speak as to that.

Possibility that fine chemicals may be sold in this country by German firms below cost price. (*See also* Qs. 4665–72.)

4681. (*Mr. Tyrer.*) I do not of course want to take your opinion on the fiscal question, but in connection with the fine chemicals would it be perfectly possible to send a considerable surplus out of the country at prices which are barely above cost?—Are you speaking of products that are manufactured here?

4682. Dr. Thorpe has referred to the manufacture of fine chemicals in Germany, and I do not at all object to the reason he has assigned for their predominance, but there are some other reasons for the present state of things and you yourself have said there are several. Is it not the fact that they could be exported from Germany to this market at prices which are just above cost price because of our free trade; has not that a great deal to do with the question?—I believe it is a matter of production, and a matter of demand. I believe that they do send many articles, and in fact I know that they have sent some articles that are sold and have been sold in this country at less than cost price. A couple of years ago or three years ago there was a large production to meet an extensive demand for acetate of soda on account of certain styles that were running amongst the calico printers which necessitated the consumption of a large quantity of acetate of soda. This demand dropped off with the result that many of the Continental manufacturers had large stocks on hand, and they were afterwards realised at less than cost price.

4683. That scarcely answers my question. One can easily conceive of a number of products which are not very large in themselves, but in which the production of a given quantity, twenty-eight pounds for instance, instead of only five pounds or two pounds or three pounds, would mean a great difference in cost, are there not?—Yes.

4684. In my own personal experience the Germans can sell such articles in England in competition with us?—Yes, certainly; it is a question of production.

4685. I am not going into the fiscal question at all, but still that is one of the reasons why we do get fine chemicals at such low prices, is it not?—Certainly, because they push the production of them to the maximum, knowing that they find here an unhampered market and a market upon which there are no restrictions.

Mr. WILLIAM HENRY MASSEY, M.I.C.E., called; and Examined.

Mr. W. H. Massey.

4686. (*Chairman.*) I believe you are a member of the Institution of Civil Engineers?—Yes.

German spirit lamp.

4687. And you are desirous of bringing to our notice certain German lamps which you have had in constant use for nearly twelve months?—Yes; I have one of the lamps here already lighted (*producing same*).

4688. (*Mr. Tyrer.*) Is that the same lamp that I had when I read my paper at the Society of Arts?—No, but it is one like it.

Mineralised methylated spirit suitable, but too costly.

4689. (*Chairman.*) Is this lamp using the ordinary mineralised methylated spirit?—Yes.

4690. Does that answer perfectly well?—Yes, it works perfectly well except that it is too dear.

4691. The spirit is not very dear, is it?—I pay two shillings a gallon for it.

4692. But that is a moderate price, because you only buy it in small quantities?—I buy a gallon at a time. One can buy this spirit in Germany for a great deal less than that.

4693. In your *precis* you say that the cost works out at three-fifths of a penny per hour?—Yes, that is about it.

4694. Is that the cost of burning of this particular lamp?—Yes, that lamp is equivalent to about thirty candles. You see it is fairly bright. This lamp has purposely never been cleaned since I had it, and the chimney has never been taken off except on the 4th May, when somebody coming into my office dropped a paper down here and broke the mantle. On the 4th May I put this mantle on. I brought the lamp here just as it is in a cab just now. I was dreadfully afraid the mantle would break on the journey, but it did not. The lamp, you see, is not clean; it shows exactly what the London atmosphere has done to it since the 28th January, about fifty weeks ago. Down in the country, where I have got the electric light as well, we can keep our lamps fairly clean.

4695. Is this a thirty-candle power lamp, do you say?—Yes, it is about that. I tried it in the other room, where you have got three electric lights of sixteen-candle power each, which would be altogether equal to forty-eight candles, and of course it was not equal to those. I should say that the chimney in its present condition intercepts quite 20 per cent. of the light.

4696. Assuming that the electric lights in this room are sixteen-candle power each, how long would it take two of them to consume a unit, do you suppose?—Eight hours.

Cost of spirit lamp and electricity compared.

4697. That, at 6d. per unit, would be about ¾d. per hour for the electric light as against three-fifths of a penny per hour for this lamp?—Yes. The cost of this lamp comes out exactly to 5d. the unit. If I pay 2s. per gallon for the methylated spirit, that is 6d. per quart, and that works out exactly to three-fifths of a penny per hour.

Cost of lamp spirit in Germany. (But *see* Q. 4735.)

4698. I suppose in London one may say that one gets one's electricity at less than 5d. per unit?—Yes, but in Berlin I can buy the alcohol for this lamp at 22 pfennigs per litre.

4699. It varies, does it not; sometimes you can, and sometimes you cannot?—It is sometimes 21 pfennigs, sometime 22 and sometimes 23 pfennigs.

4700. What is it at this moment?—I do not know what it is at this moment, but a short time ago it was 23 pfennigs.

4701. (*Dr. Thorpe.*) It is very dear now?—At 22 pfennigs per litre it is 2½d. per unit.

4702. (*Chairman.*) There are many things that are cheaper in Germany than they are in this country. Is there any reason, seeing that this is a very fairly cheap light in comparison with what we get, why these lamps should not come into common use in this country now?—I do not think they would at 5d. per unit.

4703. There are plenty of people who do not want to have an installation of electric light, I mean poor people

who want one lamp in their rooms; why should not they use it? It is not more expensive than petroleum, is it?—Yes.

Relative cost of spirit and kerosene.

4704. (*Dr. Thorpe.*) What is the relative cost—is it not as 6d. to 1½d.?—I should not like to say off hand.

4705. The cost of kerosene oil is from 6d. to 7d. per gallon, as against your 2s., so that I think you may say that it is at least four times as costly as kerosene?—I should say it is nearer six times as costly at the present selling price of alcohol.

Advanges of the alcohol lamp. (*See also* Qs. 4733 and 4741–2.)

4706. (*Chairman*) Would there be anything to prevent your using that mantle with kerosene?—I have never seen a kerosene lamp that works so noiselessly as this. To begin with, kerosene lamps for some reason or other are much more noisy than this lamp. This has a very slight hiss which you can hear if you listen. Then there is no smell with this, and if you spill the alcohol it evaporates and does not leave anything behind. In my *precis* I say that if it is spilt and set on fire you can put the flame out with water, which is what you cannot do with kerosene; you require sand with kerosene.

4707. (*Mr. Tyrer.*) And there is less liability to explosion with this lamp, is there not?—I suppose there is, but I do not know.

4708. (*Chairman.*) Is there any sale for these lamps in this country just now?—I do not know of any.

4709. (*Mr. Nicholson.*) Are the lamps obtainable here?—They are not sold in this country. I have had about eight over altogether.

4710. (*Mr. Tyrer.*) On that point, as a matter of fact, there have been several applications within the last year or so, but until within the last month or six weeks the demand in Germany has been so great, following on the Exhibition in the early part of 1903, that they could not supply them here; but they are now getting ahead and are supplying our friend Lorenz with a few?—As a matter of interest I may say that last year I gave an old friend of mine, Captain Coleridge, who is a well-known water colour painter, one of these lamps. I gave it him towards the end of January, and I wrote to him two or three days ago to ask him what his experience had been: "How long have you been using the lamp, what does the alcohol cost you per gallon, for how many hours will one quart of alcohol keep the lamp burning, and how many new mantles have you put on."

4711. (*Chairman.*) Where is he residing?—At Twyford He replies: —" Dear Massey, the lamp is a joy to me and I burn no other in my studio. It gives a splendid light, but not, for some reason, quite as bright as it was. It does not illuminate the whole mantle as it used to do. I will answer your questions categorically (1) I have been using the lamp for a year.. (2) I pay 2s. 6d. per gallon for alcohol. (3) One quart lasts nine hours. (4) The mantle that you put on for me last May or June I only took off a fortnight ago, and it then was perfectly good. I took it off as I thought that it might be in fault, but I find that the diminution of illumination is just the same with the new mantle." There is a very curious thing about these lamps. To light them up you pour in a little alcohol *here*, and apply a match. That warms the upper part there and vaporises the alcohol which is brought up by this wick. If you do not put in enough alcohol the flame is never big enough and the thing is never hot enough to incandesce the whole of the mantle. I saw Captain Coleridge's manservant this morning, and explained to him what would account for the diminution of which Captain Coleridge speaks. By putting in too little alcohol here, when the lamp is lighted the burner is only incandesced about half the way up, and it never gets hot enough to incandesce the whole. I am therefore quite sure that the little difficulty which Captain Coleridge had with the new mantle as well as with the old, is due to his not putting enough alcohol down here to light the lamp in the first instance.

4712. Then the lighting of the lamp is a trouble?—Yes. Would you like to see it done?

4713. I think it would be rather interesting?—I will turn it out, which you see is easily done, and then I will light it again.

4714. (*Sir William Crookes.*) Must not you let it cool first?—Of course, it will take longer to light it if it is quite cool; it will take from one to two minutes to light then.

4715. (*Chairman.*) Could you burn this particular lamp or a lamp like this with kerosene and a mantle?—No.

4716. Then you could not get out of a kerosene lamp so much light as you can out of this one, although you would not be spending so much money upon the kerosene lamp?—I have never yet seen any successful kerosene lamp in which the kerosene is vaporised and sent up and burnt in a Bunsen burner. This is a sort of modified Bunsen burner. I have seen several very noisy things, but I have not seen a successful one.

Spirit cannot compete with kerosene in cheapness.

4717. In order to produce the amount of light that this lamp is producing you would want more than one kerosene lamp, I should say?—I should think that you would supply the same candle power with kerosene at something between one-fourth and one-sixth of the cost of this lamp at the present selling price of alcohol.

4718. (*Sir William Crookes.*) And if the alcohol were reduced in price to the lowest possible point that it could be got to in England, it then would not compete with kerosene?—No, certainly not as far as the price is concerned, but this light would be so very much better.

4719. (*Chairman.*) What are the advantages that you claim for it to compensate for the disadvantage in the matter of price?—I do not claim anything for it; I am not interested in the lamp at all. To begin with, it is very clean, and there is absolutely no smell, and the experience of the German fire offices is that it is much safer.

4720. (*Sir William Crookes.*) Of course, you can have lamps with metal containers and safety arrangements?—Yes.

4721. The great danger of a glass lamp is that it is so easily broken if it gets upset, and then over goes the alcohol?—I think five out of the eight lamps that I have got have got brass bowls; but these glass containers look prettier when they are clean.

4722. (*Chairman.*) That seems to be very secure?—I have never tried the experiment of upsetting it.

4723. If it was completely overthrown, what would happen?—It goes out and there is no leakage, practically. The spirit might leak out, but not in any great quantity.

4724. (*Sir William Crookes.*) It is not the nature of the spirit, of course, to creep up as petroleum will?—It creeps up this wick.

4725. But the petroleum creeps round and covers all the brass-work of the lamp and stinks the place out? Yes, it does. The lamp is fairly cold now, and I will light it. I will purposely not put in enough alcohol so that you shall see what is the effect of a comparatively bad light. You see there is no removal of the chimney necessary either to light it or to put it out. After I have poured in this little quantity of alcohol and applied the match to it you see it begins to frizzle and fry, and then bursts into flame as soon as it is hot enough.

4726. If that lamp had been quite cold when you relit it, would it have been luminous like that now?—Within a quarter of a minute it is luminous, but it is not bright then; you get a light of some sort.

4727. I did not know whether that might have been due to the vapour of the alcohol remaining from the former lighting?—I do not think there is any of that, because the valve shuts it off. You see that it is not quite bright right up to the top of the mantle, but I can fry it a little more.

4728. I see you are not afraid of putting the spirit in when it is alight?—No, it cannot do any harm. If you pour the spirit all over the top here and lighted it, of course, it might make the glass very hot.

4729. (*Dr. Thorpe.*) Is that a special kind of mantle; is there anything peculiar about it?—It is a German mantle costing 3d. It is called the " Amor " mantle.

4730. (*Mr. Tyrer.*) I use the Welsbach mantles with mine?—I do not.

4731. (*Dr. Thorpe.*) Is there any special value in the mantle that you have found by experience?—No.

4732. Then is one mantle practically as good as another?—I have not tried the Welsbach, because I have not got any of that particular size.

4733. (*Mr. Tyrer.*) You may remember that at the Society of Arts we had everything. I deliberately brought all sorts of things, taking the first I could get; in fact, I

Mr. W. H. Massey.

10 Jan. 1905.

had at least half-a-dozen varieties as you may remember?—Yes. It is very valuable for domestic use. For ladies, for instance, who have got to match silks. Captain Coleridge paints by this light and by it you can sample silks of every sort of colour perfectly well. It is like mild sunlight. If you try it by the side of an ordinary Welsbach gas lamp you will find that the gas lamp is green compared with this; I suppose because the flame is not so hot, owing to the vapour of the water. This is a beautiful light to work by.

Advantages of the alcohol lamp. (*See also* Qs. 4706–7 and 4741–2.)

4734. On your figures the cost in Germany is just half what it would be in this country?—Yes.

4735. (*Dr. Thorpe.*) But not now. In 1902–3 the price of German spirit for lighting—that is, completely denatured spirit—was twenty-two pfennigs per litre. The prices have been raised several times during the present year, and it now costs from thirty-seven to forty pfennigs.—that is from 1s. 8d. to 1s. 9d. per gallon, as compared with your 2s.?—Of course, I could get the exact selling price easily enough. The Verein für Spiritus Verwerthung will give you every information.

Cost of alcohol prohibitive to extended popular use of spirit lamps in this country.

4736. Even taking it at twenty-two pfennigs per litre, that is three-tenths of a penny per hour, and that would be quite twice or two-and-a-half times as much as the cost of a petroleum lamp, would it not?—I should say it would be three times as much.

4737. So that under no circumstances does it seem to me that it would be a lamp for popular use; it would be always more or less of a luxury?—Of course, all good things are luxuries. We have had the electric light in our place now for seventeen years, and my wife and my children will not use petroleum at any price, and they use this light in preference to the electric light.

4738. But I do not know that many people would do so?—Everybody who has come to our place has wanted a lamp.

4739. For reading purposes?—Yes, amongst others. The lamps are not to be had just now, and if they were I suppose some people would be put off by the cost of the alcohol. Personally, I think that if these lamps were obtainable, and if they had the improvements suggested by Sir William Crookes just now of a safety bowl (that is, if there is any danger at all from its falling), my own opinion is that there would be a very large demand for these lamps and consequently for the spirit if it could be sold at a reasonable price.

4740. (*Mr. Tyrer*). As an article of luxury it is not a very outrageous price as it is, is it?—No. Of course I cannot produce electricity myself in the country at 5d. per unit.

Advantages of the alcohol lamp. (*See also* Qs. 4606–7 and 4733).

4741. (*Sir William Crookes.*) With electricity at 5d. per unit, what are the advantages that this lamp would have over electricity?—I am sorry I have not brought my family up. They cannot match colours by the electric light. That is all, I think, from their point of view. They cannot work by the electric light, but they can and do work by this light. Captain Coleridge could not paint by the oil lamps that he has got—he has not got the electric light—but he does paint by this light.

4742. Those are certain reasons in favour of it, but I do not think they are very important reasons to the general public?—No, but they might help. I think they are the sort of little things that help to favour a general movement.

4743. (*Chairman.*) At the present time, if the makers of these lamps had an active agent in this country, I have no doubt there would be a great many of them sold, because for country houses the absence of smell and the security of them, particularly if they were made with metal containers, would be very great attractions I think; but I doubt whether the people at large would ever use that lamp or be much encouraged to do so if the price of alcohol was reduced?—I can tell you this—that if we could get alcohol at half its present price we should use twice at many lamps at Twyford as we do now. The only thing that prevents me from sending for four more lamps is the cost of the alcohol. I can stand luxuries up to a certain point, but I cannot keep on.

4744. (*Dr. Thorpe.*) How should you say that the cost of methylated spirit could be reduced to 1s. per gallon? What conceivable rearrangement would render it possible to produce methylated spirit at that price?—That is a little bit beyond me. The cost of methylating, or whatever it may be called, in Germany is only one mark for the equivalent of about twenty-five gallons—that is, about ½d. per gallon and nobody can drink the stuff; but if you methylate spirit here by adding 10 per cent. of naphtha, the cost may be anything. I do not know what the present price of naphtha per gallon is, but I suppose it is not less than 3s. 6d. is it?

4745. (*Chairman*). It is about 3s.?—That would make it 3s. 6d. per gallon as against the ½d.

4746. (*Dr. Thorpe*). We had it in evidence an hour or two ago that the extra cost was 2d. per gallon?—It depends entirely upon the percentage. If you add 10 per cent. of naphtha at 3s., then one-tenth of 3s. 6d. must be 3·6—there is no getting away from that.

4747. I think the real price of wood naphtha is not quite 3s.?—Very well; but whatever it is, if it is 10 per cent. that is used, then it is one-tenth of the price.

4748. (*Mr. Nicholson.*) It is the difference between the cost of the methyl and the cost of the spirit that you have to consider; it is not the whole of the 3s. that you must bring into account?—No, of course it is not; it is 9–10ths of that, or whatever it may be.

4749. Supposing the price of the wood spirit is 3s. and the price of the spirit is 1s., then you have got to take the difference between the two, have you not?—Yes.

4750. (*Dr. Thorpe.*) The real cost is 2s., therefore, because, after all, the wood naphtha burns?—If you put in 10 per cent. of naphtha, surely it must be a tenth of the cost of naphtha, and all that you can set against it is a saving of 1–10th of the cost of the spirit.

4751. (*Mr. Nicholson.*) You are using a material at 3s. per gallon instead of a material at 1s. per gallon; that is all, is it not?—Yes.

4752. Therefore you have got to take the difference, which is 2s.?—But you do not put in equal quantities; you take 1–10th of one and 9–10ths of the other.

4753. (*Chairman.*) I rather gather from the figures that you have produced that in order to make this lamp a lamp that would be used by the masses of the people, we should have to cut down the price of methylated spirit to about one-fourth of what is it now, for this reason—that unless you could get methylated spirit down to 6d. per gallon, it would still be dearer than petroleum?—Yes.

4754. The Germans are in this position—that as they cannot get petroleum at anytheng like as cheap a price as our people can, it is worth their while to take these lamps when spirit is at 1s. per gallon?—Yes.

Spirit lamps not used, even in Germany, by common people.

4755. We cannot have it both ways, can we? Our people have the advantage in petroleum, and the Germans have the advantage in spirit?—Yes, and I think you will find that they actually put a duty on the petroleum which of course makes it all the better for the alcohol. I was not thinking of the masses; I was thinking more of the large number of people living in the country who have not got the electric light, and who have not got gas, who may like a decent light if the alcohol is only sold at a decent price.

4756. Does not the fact that one firm sold 53,000 lamps in three months in Germany show that it is the common people in Germany who are using these lamps?—No, if you will forgive me for saying so; it is not the common people at all. A great many of the people are country people, who, some of them, had the electric light and gave it up, and are using these lamps instead.

4757. In this country we have advantages as regards electric-lighting and advantages as regards gas and petroleum?—Yes. If you will allow me, when I go away I will leave the lamp to be called for. I do not want to leave any of this spirit in this little bottle, so I will put it into the lamp while it is still alight. That seems to me to be a safe place for it. When I lit it, it was a few minutes past 4, and the alcohol then was up to this corner place, so that it has only burnt that much in an hour and three-quarters. It will go down to nearly the bottom of the bowl in about ten hours, and a quart fills it up to that line again.

FOURTEENTH DAY.

Tuesday, 31st January, 1905.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. *(in the Chair).*

* Sir W. H. HOLLAND, M.P.
The Hon. J. SCOTT-MONTAGU, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. W. SOMERVILLE.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.
Mr. E. C. CUNNINGHAM *(Secretary).*

Professor CHARLES VERNON BOYS, F.R.S., called; and Examined.

Professor C. V. Boys. 31 Jan. 1905.

4758. *(Chairman.)* You come as a representative of the Automobile Club, I understand?—Yes, they have asked me to come.

4759. As a club have they any distinct and definite views upon the subject of the use of spirit for motors?—Perhaps I should say at once that I have not been instructed by them to formulate any views at all. Of course, in common with all users of motor cars and of spirit motors, we have the feeling that we do not want to be restricted unnecessarily; especially in the early stages when everything must be experimental.

Alcohol as a motor fuel. Methylated spirit suitable but too costly.

4760. At the present moment it is open to anybody who chooses to use the mineralised methylated spirit for power, is it not?—I believe so.

4761. Is there any objection to the use of mineralised methylated spirit?—There is no objection to that, except the fact—and when I say it is the fact, I mean it is my belief—that methylated spirit, as bought in England, is expensive as compared with what it is on the Continent.

4762. It is rather more expensive here than on the Continent; the present price in this country, buying it in small quantities, you may take at from 2s. to 2s. 6d. per gallon?—We buy it in the usual quart bottles for domestic purposes, of course.

4763. And buying it in that way, you can get it for 2s. to 2s. 6d. per gallon?—I have never bought it except by the quart, and then I do not know what I have paid for it.

4764. As regards the character of the methylated spirit, you, at the present moment, are not able to say that there is any objection to it?—I have no objection, from an engine user's point of view, to the material that is put into the spirit. Of course, everything that is put into the alcohol should be itself akin to the alcohol, in the sense of being a fuel that will vaporise with the alcohol; and if it is better, volume for volume, so much the better. Take the case of benzine; that is a case in point where you have got an exceedingly good fuel; and if it might be used with the alcohol, it would be an exceedingly good thing.

Benzol as a denaturant. (*See* also Q. 4858–75.)

4765. Using the benzine, you mean, as a denaturant of the spirit?—Yes, I am referring to the ordinary benzol from the gasworks.

Use of alcohol for motors a question of future rather than present importance. (*See* also Q. 4787.)

4766. What is the exact position at the present moment of the question of utilising spirit as fuel for motor cars?—The position is this, that at the present time in England, so far as I know, nobody has attempted to use it and nobody wishes to use it because petrol, so far, is cheaper and also answers admirably. But the view of a great many people is that the supply of petrol, being in a few hands, may be diminished or its price may be raised, and then there will be nothing to turn to as a competitor by which compulsion can be put upon those who supply the petrol in order to make them keep down the price.

4767. Have you followed the progress which the use of spirit has made abroad, say, in France or in Germany?—I have not followed it in any detail.

4768. My impression is that in neither of those countries is spirit largely used yet, whatever may be the case in the future; what is your view on that point?—I do not think it is likely to be largely used yet. I think its use from the motor car user's point of view is not at all strongly immediate—I think it is very largely in the future.

4769. Now let us take Germany. Germany specially encourages the production of spirit and its use for any purposes for which spirit can be used in preference to any alternative; and Germany also discourages and penalises the use of imported goods such as petrol?—Yes, I am aware of that.

4770. But the result of that is that at this moment spirit is cheap in Germany, and the other agents are dear relatively, yet in spite of its cheapness in Germany they are not making much progress with the use of spirit for driving motor cars?—And I do not think it is likely they will, because the whole of the experience of the world has been built up about the petrol engine, and the people who are in the trade want to sell their cars, and want to sell every car with the certainty that it is going well; therefore they tend towards petrol. But they are not prevented from using their best endeavours to make such changes as will be necessary in the engine to fit it for the consumption of alcohol. With an increased price for petrol, and with the extraordinary advantage that is obtained from alcohol—I mean the advantage from an economical point of view resulting from its high duty, which depends on its physical characteristics—there is every reason why if alcohol can be used it should be used.

Alcohol, though giving more work per heat unit, is a less efficient fuel than petrol. (*See* also Q. 4813).

4771. Quite apart from the question of price, what advantages has alcohol over petrol?—You must take the price in comparison with the volume, and also in comparison with its thermal units—those three things all enter into the consideration. The great merit of alcohol—and this perhaps appeals to the scientific man more than to anyone else—is the fact that a larger proportion of its calorific value can be converted into work than is possible with petrol; so that in spite of the fact that the calorific value of alcohol, which already contains combined oxygen, is a great deal less than the calorific value of petrol, so much greater is the proportion of heat which can be converted into work that it runs petrol very close as a fuel, though it never equals it and cannot equal it.

4772. Do you mean that it cannot equal it in this sense, namely, that a gallon of alcohol will not give you as high a running power as a gallon of petrol?—It is not so very much heavier than petrol. The comparison may be either by weight or by volume, but I think by both alcohol comes out inferior, though only slightly inferior.

4773. Then supposing the two things were at the same price per gallon, the petrol would be the cheaper fuel to use?—Yes, I think so.

4774. Because a gallon of petrol would carry you further than a gallon of alcohol?—I was just saying that I am not quite certain, because I have not got the figures at my fingers' ends. I did not trouble to prepare them, because they would not have been of my own making,

Professor C. V. Boys.

31 Jan. 1905.

and so I should be merely repeating other people's figures, and that is not evidence, of course. Either by weight or by volume—I forget for the moment which, but I am inclined to think by both—alcohol would always stand second to petrol.

4775. (*Dr. Thorpe.*) Of course petrol is very much lighter?—It is about ·625 as against—what is alcohol?

4776. Alcohol you may put down as ·8, and the ordinary petrol as below ·7, may you not?—I will take that from you.

4777. (*Mr. Scott-Montagu.*) Is not the ordinary petrol about ·7 to ·720?—I was thinking of the pentane we use, which is a lighter petrol than the ordinary petrol. We get it at ·625, I think—at any rate, it is very light stuff indeed.

4778. (*Dr. Thorpe.*) That is one of the lightest liquids known?—Yes, and it is very good stuff. That is the material I am most familiar with in regard to these paraffins. That is what I was thinking of when I said it was among the 6's.

4779. (*Mr. Scott-Montagu.*) I think you can take it that ·7 to ·720 is about the average of commercial petrol?—Then obviously it is not so very much lighter than alcohol.

The future of alcohol as a motor fuel lies in possibility of a rise in price of petrol. (*See* also Q. 4891–4.)

4780. (*Chairman.*) What is the price of petrol at the present moment?—I buy it in a two-gallon tin at rare intervals. The amount I use with a motor bicycle is very small, and I use the most expensive, but I do not remember in the least what I pay.

4781. (*Mr. Scott-Montagu.*) Would it be 1s. 2d. per gallon?—I pay more than that. I get Carless and Capel's petrol, and it is more expensive stuff than Pratt's, which is almost always used. I have never bought that except by the wayside, and you rarely get the other in that way. I buy a two-gallon tin from an oil-shop occasionally, but when running these machines, as they do not hold very much, it sometimes becomes a question of filling up by the roadside, and then you pay any price and get any sort of stuff.

4782. (*Chairman.*) Buying it in comparatively small quantities, and without making a contract or anything of that kind, it has been quite easy to get it at 1s. per gallon lately, speaking roughly, has it not?—There has been no difficulty in getting petrol up to the present time; indeed, you may say there has been no difficulty and no trouble at all. What I have in view is only the possibility of the petrol supply failing or being cornered. In case such a thing were to happen, the people who use motor cars would be in a very bad position indeed; in fact, they would be unable to drive the cars, except at an extravagant price.

Petrol cars not adapted for alcohol without alteration. (*See* also Q. 4799–4802.)

4783. How are you to get over that difficulty? You would require different machinery for using alcohol from that for using petrol, would you not?—You would require certain parts in different proportions. I do not think it would be right to say it would be impossible to design an engine that would work both, with the adjustment always to hand so that it could be used either for the one or for the other; but a machine designed only for petrol is no good for alcohol, and *vice versa* a machine designed only for alcohol is no good for petrol.

4784. In order that alcohol should be regarded as an alternative to petrol, it would have to be obtainable at very considerably less than its present price, would it not?—I do not think it is possible for alcohol to compete with petrol at its present price. It is only the possibility of petrol becoming ruinously expensive as compared with our present prices in England that would give alcohol any advantage.

Excise restrictions on sale of methylated spirit. (*See* also Q. 4824–5.)

4785. As regards the existing regulations in respect of methylated spirit, they interpose a certain difficulty owing to the fact that a retailer of methylated spirit may not sell more than a gallon to one person at the same time. If each sale were limited to a gallon, then, of course, if alcohol were being largely used that would be a serious difficulty?—Yes, but I imagine that such machinery as exists for altering regulations would be applied, and that that would not stand in the way.

4786. The regulations could be easily altered, of course?—If a small detail of that sort became a real grievance, it would be altered, I imagine.

4787. Then, really the question is not a question of the present moment so much as a question turning on contingencies that may hereafter arise?—I should say so, I am speaking of England alone, where we have no import duties upon the material, and it comes in free.

Experiments with alcohol. Greater compression possible than with petrol,

4788. Have you any knowledge of experiments in the use of spirit for motors?—I have made no experiments myself, and I have not closely followed any experiments. I know the results of experiments showing that greater compression is possible without self-ignition. Putting it very shortly, the greater the compression within reason that can be used in an engine running on the Otto cycle—the 4-stroke cycle, as it is called—the greater will be the proportion of heat converted into useful work. That is limited to a compression of about five atmospheres with petrol, because beyond that the gaseous mixture is heated up by compression to such a point that it fires itself; then you have the engine firing on the wrong side of the dead-centre, and anything beyond that becomes impossible; and you do not want to have the risk of it, of course.

but there may be a difficulty in starting. (*See* also Q. 4844–51.)

4789. Is it not found that there is a certain difficulty in starting spirit motors when cold?—With alcohol there would be the same difficulty as there is in using petroleum, at the present time. Some engines will take petroleum, but they have to be started with petrol until the waste heat from the exhaust has heated up the carburettor sufficiently to convert the petroleum, which is the common lamp oil, into vapour. After that, the petroleum can be used, and the engine will run quite well upon it. The same difficulty in a less degree would be applicable to alcohol. I do not know whether it would be possible with alcohol for it to be started as a spray, cold; I should be inclined to think it would.

4790. We understood that in Germany this difficulty was found to be a great one, especially in cold weather?—Of course, and the colder the worse it would be.

4791. We were told that in the very cold weather there were very great difficulties in managing to start motors with alcohol?—I should quite accept that.

Desirability of an indigenous supply of motor fuel. (*See* also Q. 4853 4.)

4792. (*Mr. Scott Montagu.*) From a national point of view, what one has to look at is that the principal or likely supplies of petroleum (which, of course, is the origin of the petrol) may diminish, or may get so few as to enhance the price considerably?—Yes, that is very generally felt.

4793. What do you think about that yourself?—I do not think I am in a position myself to form an independent opinion upon that subject, as I do not know enough about the petroleum trade. I know this—that in the last few years petrol has gone up in price. Whether because there is a greater demand on the total supply that is available, or whether because those people who are selling it in gross feel that they can extort the extra price, I do not know; but I should think that in any case there is nothing to prevent their raising the price whenever they please.

4794. We may say, may we not, in regard to petroleum, that the supplies of the world are in two or three hands now?—I believe so.

4795. And therefore that the combined action of those who control the supply of petroleum, even though the supply is not actually diminished, might so put up the price as to make it very burdensome?—I certainly feel that that is very possible. There is another thing which might be very different—it might cut one way and it might cut the other way, and I cannot tell in which way it would act at the present time. Petroleum obtained from the wells is a mixture of oils from the lightest to the heaviest, and the price of any one grade must depend upon the sale of all the other grades. You cannot pump from the wells quantities of oil in order to sell only petrol; any one particular grade must keep pace with all the other grades, and prices will rule according to the demands for the several grades.

4796. It is also important that we should have, if possible, some indigenous supply of fuel for internal combustion engines; do you not think so?—It would certainly be a useful thing, but I do not quite know how important it would be. That is rather a political question in some respects.

4797. There are two possible states in which this country might be—one, actual war, and the other, hostilities

threatened; in either case you would have the price of all imported supplies raised, in the one case comparatively little, and in the other case a very great deal; and that would very seriously affect the utility of the internal combustion motors all over the country, would it not?—Certainly.

4798. Therefore, from a national point of view, it is important that we should have, at any rate, some indigenous source of supply, in case either of those contingencies actually came to pass?—Yes; but then you are met on the other hand by the consideration which was put forward by the Chairman just now—that the ordinary petrol engine, as it now exists, without modification is not suitable.

See ante Q. 4783. Adaptation of petrol cars for use with alcohol.

4799. Just to go on to that, as you have mentioned it, it is chiefly an alteration of the carburettor that is required, is it not?—There are two things—first, the carburettor, and then the increased compression. You do not get the advantage from the alcohol without an increased compression; but that is an excessively simple alteration; it merely means placing on the end of the piston or cylinder head a blank to fill up so much space.

4800. So there would not be very much difficulty in adapting the present petrol engine?—I do not know what difficulty there will be in the carburettor, but I should not feel any serious difficulty in that direction.

4801. It is within your knowledge, is it not, that petrol cars in France have been adapted for alcohol by merely an alteration of the carburettor, because, of course, as you know very well, the modern petrol engine has a very much higher compression than such engines used to have?—Yes, but you are limited in that way, as I have said.

4802. At any rate, the carburettor has been adapted with success in France?—I do not see any difficulty in adapting the carburettor, for the simple reason that petroleum itself can be used in some of the carburettors that are commonly running now. Take the case of the Cremorne carburettor—to mention a particular one—that runs quite well with petroleum.

The future of internal combustion engines. Desirability of removing unnecessary difficulties in the way of experiments with alcohol.

4803. Do you think it is likely that the internal combustion engine will be further developed and will eventually supersede in most cases the steam engine?—I am perhaps only repeating the common hearsay and conversation among engineers, but that is absolutely the conviction. The economy of the internal combustion engine using producer gas is very great. I am not now referring to oil or to petrol, but to the use of cheap fuel made into producer gas—the big engine using low grade gas. That is a source of cheap power, but it is only available for stationary engines.

4804. At any rate, the tendency of the mechanical world is at present towards internal combustion engines, is it not?—Absolutely.

4805. Also I think it is correct to say that their development is still going on very quickly, and fresh economies and all kinds of improvements are being introduced?—As you are no doubt aware, Mr. Dugald Clerk only quite recently has made an enormous improvement in the gas engine, increasing its thermal efficiency well up to about 35 per cent. I think now, which seems amazing as compared with the old 20 per cent.

4806. Therefore, though petrol holds its own at the present moment, it is quite possible to conceive, indeed it is highly probable, that alcohol, if some means could be found for protecting the revenue, will be valuable as an auxiliary supply though it might not be the main supply?—I think it will be a valuable auxiliary supply. What I feel, if I may express myself in this way, is this—that invention and improvement and experimental development should always be encouraged; one cannot see the limits in any direction of experimental work; and a man who has got the public spirit or the enterprise, or whatever it may be, to go ahead and does go to the expense of making experiments in designing and scheming out new devices, should not be hampered from the beginning by unnecessary difficulties. That is not the attitude which the Government should take, and it certainly is not the attitude according to all accounts which the German Government takes with regard to industry there.

4807. (*Chairman.*) As regards this particular thing that we are now talking about, namely, the use of spirit for motors, there is no hampering, is there?—I speak absolutely in ignorance; but is it not the case that the methylated spirit, even as it is, is more expensive than it need be, owing to the cost of the denaturing material or some other cause?

4808. That is possible; but I was referring rather to what Mr. Scott-Montagu had in mind when he said, "If means could be found for the protection of the revenue." We are not in search of means for protecting the revenue as regards the use of spirit for motors, because we have got the means now in the mineralised methylated spirit, and we do not want anything more. It is only a question of whether the existing regulations in regard to the spirit enhance its cost to such a substantial extent as to require consideration; and that, of course, is one of the points which the Committee is studying. Apart from that, there is nothing to prevent anybody using as much methylated spirit as he chooses, is there?—No. As far as I know that is the case.

4809. (*Mr. Scott-Montagu.*) Except the restriction that you can only buy a gallon at a time?—Yes.

Attitude of the Board of Inland Revenue towards such experiments.

4810. (*Dr. Thorpe.*) With reference to the remark which Professor Boys has just made as to the attitude of the Government with respect to the encouragement of experimental work, I would remind the Committee that in the past facilities have been given by the Board of Inland Revenue to experimenters concerned in the development of these internal combustion engines to use spirit, with as few fiscal restrictions as we could allow.

Alcohol too dear at present to compete with petrol.

4811. (*Mr. Scott-Montagu.*) As regards the price, I think we all agree that where there is no duty on petroleum at all, or on any of its by-products, alcohol at the present moment is not cheap enough to compete?—Yes.

4812. As regards this country, that is the situation, is it not?—I believe so. It is not an immediate question in that sense.

See ante Q. 4771.

4813. As regards the efficiency of the alcohol motor, as you tell the Committee, the thermal units developed are greater, and I think I am right in saying, that the diagram of the explosion is better, that is, alcohol is more effective and produces a greater dynamic result?—Yes; that is because you are able to get a better compression, and so you are able to get a larger proportion of the heat developed by combustion converted into work.

Relative solubility of benzol and petrol in alcohol. (*See* also Q. 4858, etc.)

4814. Have you studied the relative solubilities of benzol and alcohol, and petrol and alcohol?—No, I have not.

4815. You know as a matter of common knowledge of course that they are soluble?—I know that they will mix—I do not think in all proportions, but I think they will mix in all the proportions that we should ever want.

4816. As a matter of fact, you probably recollect that in the Northern Circuit in France, promoted by the Minister of Agriculture two years ago, I think, last June, the mixture used was 50 per cent. of alcohol and 50 per cent. of petrol?—I did not remember that; I daresay I read it at the time, but I have forgotten it.

4817. I am also speaking from memory, but I think that was the proportion. At any rate, there is no doubt that alcohol and petrol can be used together?—I should not have expected that alcohol and petrol would be a mixture that you would prefer to have. I should have thought that you would have preferred a material more like benzol. Alcohol and benzol I should have thought would have been a better mixture than alcohol and petrol.

4818. Would both petrol and alcohol, and benzol and alcohol, mix in suitable proportions?—Dr. Thorpe will know whether they mix in all proportions much better than I do. I am sure that in small proportions they will mix, but I am not sure that they will mix in all proportions.

4819. (*Dr. Thorpe.*) As a practical question, assuming that the mixture, without being absolutely clear, that is, without the ingredients being absolutely soluble one in another, would it very much matter if it were fairly uniform?—I should think it would, because if you take two liquids which actually do not mix in the physical sense, and become one liquid, then you will find that one will float on the other, and you will require a means of feeding them together. You could not feed first one

Professor C. V. Boys.

31 Jan. 1905.

and then the other, because in that case there would be no object in having the two. You would have to feed the two liquids severally and separately to the carburettor, which would be a complication.

4820. Could you not have a mechanical contrivance which, in some way, would keep it as an emulsion, if I may so call it?—If you kept it stirred up, that would be all right.

4821. (*Mr. Scott-Montagu.*) The very fact of the car's running would do that, would it not—a motor car running over the road always keeps the tank in continual motion?—That will not keep two liquids mixed that want to separate. It would not keep oil and water mixed, for instance. If the liquids do not freely mix they would separate; the lighter one would get to the top, and the running of the car would not mix them.

4822. Still, that difficulty could be got over, could it not?—Yes, it could be got over by mechanical appliances, of course.

Present interest of motor industry in alcohol question. Facilities desired for experimental work. (*See ante* Q. 4803-10.)

4823. Although you cannot speak definitely on behalf of the Automobile Club, I conclude you know they are taking a great interest in the matter?—I know they are. They wished me to come here, but as I said at first, I came with no instructions as to the definite matters I was to emphasise.

4824. The general wish is that at any rate, shall I say, every opportunity should be given for experimental work in connection with motor cars; and they would like very much to see the restriction of a gallon as the minimum quantity of methylated spirit which can be sold at one time removed, so that practical experiments could be made with it?—Yes. When it becomes urgent they would, I should think, make a great fuss about it, if that restriction were not removed; but I imagine, myself, that a restriction of that sort is too petty a thing to discuss seriously on this Committee. I am sure it would not stand in the way.

4825. The Chairman has said that, of course, it could not?—It alone could not stand in the way.

4826. Taking the opinion of automobilists outside the Automobile Club, and taking the opinion of students like yourself of the whole movement, is it not the general opinion that at any rate the use of alcohol in motors is a serious question which ought to be looked at, in case of the failure of the supply of petrol?—I think it is a very serious question. We do not know the future sufficiently, and, as I say, I do not think there is any serious grievance at the present time; but anything that is done by the authorities to hamper—I do not say anything is done to hamper—or which people believe is done to hamper, free experimenting is a misfortune.

No objection to character of methylated spirit for motor purposes.

4827. (*Mr. Nicholson.*) You have no objection, I understand, to the use of the ordinary methylated spirit for motor car purposes?—No, I think not; I do not know of any objection.

4828. You do not wish to put forward any other form of denaturant, or any suggestion of a reduced quantity of methyl?—No, unless it is anything else that is cheaper. I do not know to what extent the price of methylated spirit depends upon the material that is put in to denaturise it. If that raises the price unnecessarily, then, to that extent, it is objectionable. Benzol, we know, is as cheap as it can be, and I believe it would make a very good denaturant. The denaturant itself should be like alcohol or benzol, or one of the fuel liquids; it should be a fuel.

4829. But no especial form of denaturant has come under your notice which is preferable to the existing one?—That is wood spirit; is not that pretty pure methyl alcohol?

4830. (*Dr. Thorpe.*) Substantially it is?—Then there can be no objection to that.

4831. (*Chairman.*) There is a very small quantity of petroleum oil in it?—That will not make any difference at all.

Corrosive effect of alcohol as a motor fuel.

4832. (*Dr. Thorpe.*) Have you had occasion to follow the engineering literature of alcohol-driven engines?—I have followed it with a general interest rather than specially.

4833. Do you mean that you have not had the opportunity to analyse the results of alcohol-driven engines?—I have not gone into it closely at all.

4834. So that you have never seen any reports as to the appearance or character of the machinery after it has been used for some time with alcohol?—No.

4835. Are you aware that one of the most serious objections to the use of alcohol is the extraordinary corrosion which takes place?—No, I did not know that.

4836. Are you not generally aware that there is a very high degree of corrosion?—I did not know that the alcohol-driven engine was seriously damaged in that way.

4837. That, we have been informed, is one of the most serious objections to the use of the alcohol-driven engine. We were given to understand in Germany that everything which official action could do to increase the use of spirit for the supply of motors had been done; for example, we were told that the police in Berlin had done what they could to compel persons who have motor cars for hire to adopt spirit. Doubtless you are aware that in Germany alcohol has a very special interest to the State?—I am aware of that. It is a political question with them to a large extent.

4838. And the persons in power do all they can to make people use alcohol for all industrial purposes?—Yes, I am aware of that; the Agrarians push it as much as they can, I know.

4839. We were informed that even in the case of motors which are used for the general service, pressure had been brought to bear by the police of Berlin, so far as they were able, in order to compel the use of alcohol; but we were further given to understand that as a matter of fact this pressure had been nugatory from the inherent difficulties of the application of alcohol. In the first place, the corrosion in the machinery was so great, and therefore the bill for repairs was so considerable that that of itself was a very serious matter?—Where is the corrosion—in the cylinder-rings, the piston-rings, or the valves?

4840. I cannot specifically say in what part, but it was in all parts which were subject to the action of the spent vapour?—That would be in the exhaust-valve, mainly.

4841. And also, I understood, in that part where the explosion itself takes place. We were told that all the running parts of the machinery were very quickly corroded, and that that was due to the relatively large quantities of aldehyde and eventually of acetic acid which were produced. We were informed also that although theoretically much better results might, from a mechanical point of view, come from the use of compression, as you have explained, nevertheless it appeared that the increase in the formation of these acid products was so considerable that an effective stop was soon brought to this economical effect—I mean to say that after a time, although the economy on paper was very considerable, nevertheless as a practical matter the limits of that economy were very soon reached by the fact of a high compression bringing about a relatively large increase in those products which act so destructively upon the engine?—That may be so at the present time, and it may possibly be so always; but it does not follow that even that cannot be improved away. Many difficulties have been improved away that have been met with at the beginning of any industry.

4842. It is quite conceivable, of course, that some other material may be used for the running parts—for instance, that some other form of alloy might be adopted?—Or some new lubricating oil. What I meant to say was that something which we do not foresee might be done—otherwise we should go and try it at once.

4843. Anyhow, you will admit that that is largely hypothetical, and that this is a very considerable difficulty in the way?—Yes, certainly.

Difficulty of starting with alcohol. (*See ante* Q. 4789-91.) Not considered permanently serious.

4844. There is also the point to which the Chairman has referred which we were also informed about—and we were in Berlin at a time when we could oruselves verify the fact—namely, that any alcohol engine which they have at present had occasion to use is, in very cold weather, practically almost unworkable on account of the difficulty of starting it?—That is only a question of the starting. That corresponds to our having petrol engines and using petroleum in them. They cannot be started without a little petrol in the first instance to get the carburettor warm.

4845. It is not only the starting, but it is also the running for some time after the starting has taken place, that is the difficulty. Take the case of a car which has been put in an ordinary outhouse at a temperature of something like minus six or seven degrees, which in Berlin is not an infrequent condition of things in the winter time; you have got there the mass of fuel at that very low temperature?—Certainly.

4846. Therefore, although you might have started your engine, nevertheless your supply of material to go on feeding your engine with is so very cold that it does not readily volatilise?—I do not think much of that difficulty

4847. But it is a difficulty that they feel at the present time?—I daresay, but I do not think much of it, because the waste heat from the exhaust of the engine is enough to evaporate all the alcohol twenty times over, and it is only a question of the proportion of the by-pass from the exhaust into the carburettor in order to warm and evaporate the alcohol at any temperature. That is nothing.

4848. Be that as it may, that difficulty has not been solved in that particular way in Berlin?—It is quite likely that they have not done it yet.

4849. They attempted to solve it, we were informed, by largely increasing the amount of benzol which they had mixed with the alcohol. Then they were left with another practical difficulty, very much of the same order—that in proportion as they increased the benzol they also increased the liability to the consolidation and crystallisation out of the benzol, the benzol being a substance which crystallises at a comparatively moderately low temperature?—Yes; and I would put forward another likelihood of trouble from increasing the benzol too much—that is, the formation of soot and dirt in the cylinder. Benzol alone is a very untractable fuel.

4850. The way in which in Germany that little difficulty as to the crystallisation of the benzol was got over was by increasing the amount of toluol, which is a hydro-carbon which does not readily freeze, but which increases the cost of the fuel very considerably?—Of course we have very cold weather in England sometimes, but not to the same extent they have in Germany. I do not seriously think the difficulty of starting is a difficulty that we need consider as one at all permanently serious, because we have got plenty of experience of the running of cars on petroleum.

4851. I quite agree with you that it could be got over, and it would be got over, would it not, by an alteration in the construction of the engine?—Yes.

4852. But still I am afraid it is a far cry to get over the effect of the corrosion?—Yes; that is a much more serious thing, without any question.

Indigenous supply of motor fuel. (*See* Q. 4792–8.) Shale oil.

4853. With respect to the remark that fell from Mr. Scott Montagu as to the desirability of having an indigenous supply, have we not got an indigenous supply of hydro-carbons already?—We have the shale oil, and we have also what is not very well known yet—certain products from the tar from carburetted water-gas plant. But here, after all, the tar is a product of the cracking of the heavy oil used for carburetting, which, again, is imported petroleum,

4854. If the price of petrol touched a certain figure not very remote from what it is now, is it not possible that a very much larger quantity of these light hydro-carbons could be made from our own source of supply?—I do not know what proportion of the shale oil is lighter. I cannot remember.

4855. (*Mr. Tyrer.*) You seem to think that the general policy with regard to industry should be that the difficulties of supervision, and of all questions in connection with denaturants, should, in the interest of industry, be reduced to the smallest amount?—Certainly.

4856. That seems to be the general line that you take?—Yes; every unnecessary expense should be abolished.

4857. The wood naphtha to which you have referred adds, of course, a very important amount to the relative cost of the spirit?—Yes.

Benzol as a denaturant. Possibility of separating the spirit and consequent risk to Revenue discussed

4858. There might be something used other than that, and then concessions might be made under certain circumstances with due regard to the safety of the revenue. With regard to your reply as to benzol and petrol, did I understand you to say that you knew that they were both of them soluble in all proportions absolutely?—No; I said I did not think they were soluble in all proportions.

4859. They are soluble in all proportions of absolute alcohol, but not in the ordinary spirits of wine and methylated spirit?—Just so; those contain a little water.

4860. I am not quite sure whether your attention has been drawn to this point: Dr. Thorpe has before, when referring to the evidence presented to this Committee, referred to the fact of the comparatively easy separation of benzol from spirit?—I know that petroleum can be separated from spirit by watering it and filtering it, and then distilling it.

4861. And so with benzol?—Benzol, I daresay, can, but I did not know that it could be separated entirely.

4862. Do you think, assuming it can be separated entirely, that that would be a serious objection to the use of this mixture?—No, I should think not, and for this reason—I am glad you have asked me that question as I wanted to put this forward—the restrictions as to the use of stills all over the country are so severe, and the difficulties of using them are such, that the purification of the alcohol again by distillation could be stopped just as certainly and as easily as the production of alcohol from potatoes or sugar or anything else. Of course, if anybody has got a mind to make alcohol now, he can—if I, for instance, chose to make it on a small scale, I could go and make it, and nobody here would know.

4863. Taking your risk of being caught?—Certainly. I do not say I would do it, but if I chose to do it, I could. As far as I know, the distillation of alcohol by any process would be equally illegal, and if you can stop the one you can stop the other. Of course, if a man is going to do an illegal thing and thinks it worth his while, he will do it.

4864. You do not think, as a matter of practice, that it would be worth the while of anybody, under the conditions under which automobilism is carried on, to buy the quantities which are allowed (or likely to be allowed, even giving extended limits) of, shall we call it, spirit denatured in this way with benzol in order to purify that spirit?—I should say it is quite absurd, because what you can do with a retort, or with a little still in a corner of your room, would be absolutely futile for the purpose of making money, and if it were done on a large scale with a still such as is used for distilling whiskey, or anything of that kind, so many people must know about it that it would be found out.

4865. A matter has been referred to once or twice which is not quite in the direction of what I may call favouring the contention, but still it is a fact. Are you aware that, in diluting a mixture of benzol and alcohol with water, the benzol separates almost entirely, and leaves the alcohol in a state of very remarkable cleanliness?—Do you mean, making it better than it was before?

4866. If it was methylated spirit, certainly?—I did not know that.

4867. I heard Dr. Thorpe make some inquiries of our witnesses on that, and I was not aware of the extent to which it took place. I am bound to say that the result of my experiments is to show that under certain circumstances—certainly almost inconceivable circumstances—such a thing could be done—so that the process of distillation is not absolutely necessary?—Then you have got your alcohol watered down to a great extent?

4868. I admit all that; that is one of the points against defrauding the revenue or playing tricks of that kind?—Do you mean to say you get whiskey and water when you water it down, and you do not need to distil off the water? If the price of petrol should rise to such a point that alcohol is certainly wanted, I was hoping that benzol, together with some objectionable chemical—objectionable both to taste and to smell—could be available for mixture with the alcohol for the motor-car user. That might just make all the difference in the world; a few pennies, I mean, would be quite a consideration.

4869. I said a moment ago that in consequence of what Dr. Thorpe had said some time ago I had made some experiments. I found that benzol and petrol were soluble in all proportions of absolute alcohol, but not in the other alcohol, and that, as you observed, was due to the water. The amounts of benzol and petrol

Professor C. V. Boys.

31 Jan. 1905.

required to produce turbidity in spirits of wine as ordinarily understood, that is to say undenatured, and methylated spirit—were just these: 163 parts of benzol and twenty-five parts of petrol to 100 parts of ordinary spirits of wine?—So that the benzol is far more miscible than the petrol.

4870. When you take the ordinary methylated spirit here is a curious thing—300 parts of benzol and forty-seven parts of petrol to 100 parts of methylated spirit. —That is because the methylated spirit contains less water than the spirits of wine.

4871. There are the ten volumes of wood naphtha in it?—That all helps. Methyl alcohol is a better solvent for the other two.

4872. Then as to the amount of water required to produce turbidity in a mixture of spirit with petrol or in a mixture of spirit with benzol, here is a point which is of considerable importance—I am sorry, but it is so:—with absolute alcohol ninety parts, and benzol ten parts, (so that the denaturing volume is as one to nine), seventy parts of water are required to produce turbidity. With ninety parts of alcohol and ten parts of petrol only 32·5 parts of water are required to produce turbidity?—But the producing of turbidity does not mean complete separation?

4873. No, although it is getting on that way. At that point if you leave it long enough, you know you will have separation eventually. When we get down a little further with ordinary spirits of wine in the same proportions, we find that for benzol thirty-eight parts of water are required to produce turbidity, and in the case of petrol only seven parts?—Those figures have not been before me.

4874. This is remarkable—here is a mixture of ninety parts of absolute alcohol and ten parts of benzol requiring seventy parts of water to produce turbidity and so on. The curious part of it—I mean the unsatisfactory part of it from Dr. Thorpe's point of view—is that this separated spirit is not so abominable as I should have imagined it would be. After it had been diluted down to what Dr. Thorpe has described as proof spirit, and a still further 10 per cent. added, all I can say is that it would not be a very difficult thing for the depraved tastes of some of my own people to go and drink it like a shot?—That seems to me to be readily answered. The moment you remove the expectation that people will require the use of a still for illegal purification, you can introduce some abominable flavour or poison. Recollecting the amount of organic chemical bodies that I had put before me when I was attending the lectures of Dr. Thorpe's predecessor at South Kensington, Dr. Frankland, I should have thought that there was no difficulty in finding bodies that would cost nothing, but which, from their flavour or their smell or their being poisonous, would settle that last question, so that distillation would then become essential for their removal.

4875. Then there is the difficulty which has been pointed out; attempts at distillation have been made, and successfully made, until they were discovered, but they were sufficiently serious to cause a still more rigid application of such powers as the Excise possessed?—Certainly. Two things are new to me, one is that so little water is sufficient for the purpose of the separation; I knew that water would do it, but I was under the impression that a great deal more water was required.

Increasing demand for petrol. Tendency to supplement supply by using heavier oils.

4876. (*Mr. Scott-Montagu.*) In connection with this question, of course all of us look forward to a very large increase in the number of internal combustion engines using hydro-carbons?—Yes, the internal combustion engines are increasing out of all knowledge at the present time.

4877. There are, of course, two points to be considered, one is the possible failure or diminution of the supplies of petroleum, and the other is the increase in the number of engines using petroleum. Should you say it looks rather likely, as far as you can see, that both those things will happen in a not very remote future?—Yes.

4878. That the supplies may tend to diminish, while the amount of petroleum and petrol necessary for consumption in these engines will certainly increase?—That is quite clear. The latter statement is obvious; the former one is a question of probability and one cannot tell.

4879. One has to look at the fact that humanly speaking, even if the present supplies of petrol were to be kept up, they would not be sufficient for us in ten years time?—That is so.

4880. Or even in five years time?—Already the proportion of the distillate that is put into the petrol boxes covers a wider range than it used to do, which means that the amount distilled within the limits that we should like to use, for surface carburettors especially, is not sufficient and is made up by heavier petrol being put in.

4881. The tendency has been within the last two or three years to increase the gravity, has it not?—That is another way of saying the same thing.

4882. I suppose you remember that we had an agitation last year on that very question?—I remember that.

4883. I daresay you saw some of the figures which I published in the "Car"?—I have no doubt I saw them, but I have got a beautiful memory and figures evaporate.

4884. I published figures rather in favour of petrol as against alcohol as far as that is concerned; I showed that you can use petrol of a good deal higher specific gravity than is used now, in fact I think I went up to ·750?—Then you were not using a surface carburettor. With the ordinary spray carburettor you have got a much greater range.

4885. It was proved practically then that you could work up to about ·740 or ·750?—Yes, but you have the starting trouble, or you may have.

4886. You may have that in cold weather?—It all depends on the design of the carburettor and the engine.

4887. And on getting a large proportion of the hot air from the exhaust?—Yes.

4888. (*Dr. Thorpe.*) With a liquid of that specific gravity you would not have what we generally understand as petrol, that is to say a light petroleum which consists substantially of pentane; you would have much higher hydro-carbons when you get up to a gravity like that?—There is not much pentane in the petrol, is there?

4889. There is a very considerable amount in the petrol; for the petroleum and petrol are substantially the same things are they not?—Yes.

4890. (*Mr. Scott-Montagu.*) I am rather inclined to agree with the managers of some of the petroleum companies who came to see me about this point, and who declared that at any rate with over ·720 you get better results?—Certainly, the heavier petroleum is a better material.

4891. (*Dr. Thorpe.*) Are any attempts now actually made to use the exhaust heat with a view of vaporising the petroleum?—Yes, that is very common.

Use of the heavier oils suggested as probably best way of meeting a rise in prices of petrol.

4892. (*Mr. Scott-Montagu.*) We have done that for the last four or five years, have we not?—I think so. I am thinking more especially of the little motor bicycles; even on those little things you take a by-pass from the exhaust. The whole point is the starting. If I may express my opinion—and this is purely a question of opinion, and it is to a certain extent at variance with the view which the Automobile Club would like one to express, but it is my view—the future in this direction, the cure I may say for expensive petrol, will be the arranging of the carburettor so as to burn a very much heavier oil, and keeping a reserve of petrol as a starting agent; so that ultimately, when petrol becomes scarce, there will be a small petrol tank which will contain the expensive material which will be used as a starter, and then, as soon as you have got your exhaust heat sufficiently up, you will go on and use the heavier liquid. That is my practical conclusion as to the future.

4893. Looking ahead, I think at the same time there will always be a demand for spirit of very light specific gravity for the smaller engines, on motor bicycles for instance?—Yes. I very much prefer the light stuff with the surface carburettor; there is nothing so nice.

4894. It is quite conceivable that alcohol, not perhaps by itself, but in some proportion with benzol, or with petrol, might form a very excellent mixture?—I should think so.

Fire Danger. Alcohol and petrol compared.

4895. (*Mr. Tyrer.*) If the petrol gets higher in specific gravity that very serious consideration of danger becomes minimised ?—Yes, you would then use a smaller amount of dangerous petrol.

4896. Apart from that, but in the same line of thought, it is a fact I presume that taking the comparative danger of petrol and of alcohol, you would regard alcohol as the least dangerous ?—It is clearly far less dangerous from the point of view of the vapour igniting from stray fires than petrol. The vapour is not so heavy as the vapour of petrol, besides being formed in less quantity, and so it does not travel so far along the floor to a light, perhaps in another room ; but there is this to remember about the alcohol when it has caught fire—that it is not always visible. A few days ago, I think it was in Paris, I heard—but this is only hearsay—that a man's car had caught fire and the alcohol flame in the daylight was not visible, so he went into it and was badly burnt, as he did not know there was any fire there at all. The flame being invisible in the daylight did not warn him, so, as I say, alcohol is more dangerous in this sense.

4897. (*Dr. Thorpe.*) From that point of view, mineralised methylated spirit would be an admirable security ?—Yes.

4898. (*Mr. Tyrer.*) There is another point which has struck me in reading the papers within the last day or two, and that is an observation made by Sir William White ?—I am sorry that I did not read his lecture, although I saw he had given it.

4899. He pointed out that the compression engine was practically going to work a revolution, which seems highly probable from what you and Mr. Scott-Montagu have said ; but while I was reading it, noticing that Sir William White was referring to petrol and hydro-carbons of that order, it struck me whether he had in his mind, or whether it had ever been brought to his notice, that alcohol would avoid some of the troubles that might happen on board ship ?—For purposes on board ship—I must not express an opinion in opposition to Sir William White's—but I should have thought that if you were going to take ships across the Atlantic with explosion engines you would use producer gas. I do not understand petrol being used for that purpose.

Adaptability of petrol engines for alcohol.

4900. With reference to the engines which have been up to comparatively recently used in Germany, they are the old type of petrol engines, even the heavy motors using spirit there lately are almost unmodified petrol engines, are they not ?—I do not know as a fact what they are, but I do not quite see that that would affect the question of the corrosion. If you take an old petrol engine without any modification in the compression, you will not be using it to the best advantage for the alcohol. If you put in a compression piece, then I do not think the fact that it was made for petrol would affect the question at all ; but the possibility of curing it of course remains. A difficulty has to be discovered for the first time, and the cure of course cannot be discovered before the difficulty is.

4901. I ask that question because after my paper at the Society of Arts I exhibited a number of photographic slides from such illustrations as had appeared in German books, French books, and so on, and one of the speakers said " These are modified more or less—rather less than more —but they were originally petrol engines, so that they are not really up to date and there are very few really up to date among the everyday working machines." What can you say to that ?—Of my own knowledge I cannot say anything on that point.

FIFTEENTH DAY.

Wednesday, 1st February, 1905.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the chair*).

Professor Sir WILLIAM CROOKES, F.R.S.
Mr. LOTHIAN D. NICHOLSON.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.
Mr. E. C. CUNNINGHAM (*Secretary*).

Mr. GEORGE SMITH, F.I.C., F.C.S., F.R.S.E., called ; and Examined.

4902. (*Chairman.*) You represent the Nobel's Explosives Company, Limited, I think ?—Yes.

4903. What position do you hold under the Company ?—I am one of the Works Managers of the Company, being the manager at three of their works.

Nobel's Explosives Company. Fulminate of Mercury. Practical working of concession under Finance Act, 1902.

4904. As we know, Nobel's Company have taken advantage of the Act of 1902, and since May, 1903, they have been using spirit specially denatured for their own particular purpose ?—Yes.

4905. Can you give us the quantity used ?—Up to the 31st December, 1904, 181,292 proof gallons.

4906. That is in about nineteen or twenty months ?—Yes, from May, 1903, to the 31st December, 1904.

4907. Has your employment of spirit increased since you began to work under the Act of 1902 ?—Yes.

4908. Is it continuing to increase ?—Yes.

Denaturants used—recovered spirit and bone oil.

4909. What exactly is the special denaturation to which you subject your spirit under the regulations of the Board of Inland Revenue ?—In the manufacture of fulminate of mercury a quantity of vapour is given off as the chemical reaction goes on, which is condensed, neutralised, and distilled, and the result is called recovered spirit ; then we use 10 per cent. of the recovered spirit with the pure alcohol, and 0·025 per cent. of bone oil in addition.

4910. Is the alcohol, as denatured in that way, perfectly suitable for your purpose and effective ?—It is suitable, but it does not give as good a result as it would if some of the recovered spirit, or, in fact, if the whole of it were left out.

Bone oil alone would be preferred (*See* also Q. 4949–52 and 4970–80).

4911. Is there any other formula that you would suggest ? Would you, for instance, increase the quantity of bone oil ?—If that were considered necessary, I should not object to it, but I do not think it is necessary. Having regard both to the taste and to the smell, I think it is quite bad enough.

4912. Bone oil, you think, would be sufficient without the recovered spirit ?—Yes ; it is simply an abominable mixture, and I think the smell is quite sufficient to keep people from drinking it.

Procedure as to receipt and denaturing of spirit.

4913. Would you explain to the Committee the exact procedure that is followed as regards the receipt of the pure spirit in the factory and the denaturing of that spirit ?—The spirit having been received, we give notice to the officer of Inland Revenue, who attends and takes what he calls an account of it—that is, the strength of each barrel and the contents.

4914. That spirit comes from a duty-free warehouse probably, or possibly straight from a distiller ?—I do not know about that ; it comes from Liverpool.

Mr. G. Smith
1 Feb. 1905.

4915. When it comes from Liverpool it comes under bond ?—Yes.

4916. Therefore, besides your receiving an invoice of it, the Excise officer in the neighbourhood receives what is called a despatch, does he not, or do you not know about that ?—I do not know.

4917. The Excise officer is not dependent upon you for an intimation that you have received spirit, is he ?—I could not say as to that, but we always give notice.

4918. It must be so, because the spirit moves under bond, and if spirit moves under bond, then there is a despatch sent from the Excise officer of the warehouse or distillery from which it goes to the Excise officer at the place where it has got to be received, so that he has an intimation. However, that does not concern you. When you have received the spirit you give notice of its reception, you say ?—Yes, we give notice to the Inland Revenue officer, and we ask him to attend then and see to it.

4919. He attends and takes the quantity and the strength of the spirit ?—Yes.

4920. In what sort of vessel does it come as a rule—in wooden casks or in drums ?—In wooden casks or puncheons holding about 100 gallons each.

4921. Do you use any metal drums ?—No, we are not allowed to, apparently. That is a point I am going to bring before you.

4922. How do you mean that you are not allowed to use metal drums ?—They tell us that the Inland Revenue authorities have no power to allow the transport of spirit other than in barrels. I have never asked them about drums, because that is no better than what we are doing now. Our idea is to get it in in bulk.

See post Q. 4953–6 and 4995–5002.

4923. In large tanks, do you mean ?—Yes ; and they tell us they have no power to do that.

4924. At present those tanks do not exist in the country, I suppose ?—No, but they will if we get permission.

4925. Would they be tanks on a railway truck, or would they be practically a railway truck fitted with a tank on it ?—They would be tanks on the under framework of a railway truck, the same as they carry tar liquor about in, and that sort of thing.

4926. Would that tank be detached from the truck when it reached the station ?—No, it would all come into the works.

4927. Do you mean that you would run it straight in on the railway truck ?—Yes.

4928. The Excise officer, you say, takes an account, as they call it, of the spirit received ; do you at once proceed to denature it ?—Not as a rule. I do not think it has ever been done in that way. The regulations, I think, but I am not sure, are to the effect that taking the account is all that can be done that day ; and you have to start and do it all over again the next day.

4929. What do you mean when you say they do it all over again ?—If we mix the next day, then the officer comes and takes the contents over again.

4930. That is in case you have abstracted anything in the interval ?—It is all locked up in the warehouse, and he has the keys ; we do not have them. Anyhow, I suppose that is for making quite sure of it. I do not quite see the use of all that, but they do it.

4931. Is it under the Revenue lock ?—Yes.

4932. So that you could not get at it ?—No. It is in a warehouse.

4933. How long an interval elapses as a rule between the receipt of the spirit in the factory and its denaturing ?—If it came in on a Saturday, it could not be mixed till Monday ; but supposing it came in on a Thursday and we were wanting it, the probability is that it would be mixed the next day.

4934. There is nothing except the difficulty as regards time to prevent its being mixed that very day, is there ?—I have always understood that there is some regulation to the effect that it is not to be mixed that day ; that is what I am told, but I am not sure of it.

4935. What quantities do you denature at one time ?—About 2,000 gallons at a time.

4936. That would be about twenty puncheons ?—Yes.

4937. When the spirit has been denatured with this mixture what is done with it ?—It is then pumped into the store tank from which the factory is supplied. Storage and distribution of the spirit to the works.

4938. Is that tank under any Revenue lock ?—Yes, it is locked up, that is the man-hole is locked up, but, of course, the outlet is not, because we can draw from that.

4939. Is there any indicator on the outside of the tank to show how much you have drawn off from time to time ?—There is a gauge to show that, but there is no account taken of how much we take out of this tank.

4940. Have you to keep any account of your drawings-off and of how it is used ?—No.

4941. Do you not keep a book to show the different drawings ?—I take it that it is in the position practically of methylated spirit, that it is denatured and handed over to us as was the case in the old days when we used the methylated spirit. There was no account kept. Directly it is denatured in that way it is handed over to us, as was the methylated spirit, and there is no further account taken of it.

4942. Only it differs from the old methylated spirit in this way, that with the methylated spirit, if you did not want to use it in your works there was nothing to prevent you using it somewhere else, whereas with this spirit you are limited to using it in your works, are you not ?—No, there is not that difference. When we used methylated spirit we were not allowed to use it anywhere else but at the works.

4943. Then it was the ordinary methylated spirit ?—Yes.

4944. And you did not use what they call mineralised methylated spirit ?—No.

4945. In what way does it pass from the tank containing the denatured spirit to the works where you are going to use it ; is it in pipes ?—Yes.

4946. Closed pipes ?—Yes.

4947. Therefore no access can be got to it by the factory hands ?—No, unless at the other end of the pipe.

4948 What happens at the other end of the pipe ?—The other end of the pipe is quite open. It is fixed to a tap and they use that in the building in which the fulminating manufacture goes on.

4949. You said you are not quite satisfied with the present formula for denaturing, and that you would like to get rid of the recovered spirit ?—That is so. Proposal to dispense with use of recovered spirit as a denaturant. (*See ante* Q. 4910–2 and *post*. 4970–80)

4950. Is that recovered spirit pretty strong ?—When it is distilled it is about thirty over proof.

4951. If you did not use it in that way, how would you use it ?—As a matter of experience with the use of pure spirit, we find that if you concentrate that spirit considerably more than it is concentrated now, you get a very much better result. In the manufacture of the fulminate the stronger the materials you employ the better yield you get, that is the stronger explosive, and—what is of very great importance to the cap trade, with the various fulminates used for the percussion caps—you get a larger crystal. So that what we are going to try to get the Revenue to allow us to do is to do away with that recovered spirit. We should concentrate it and we would only get then about sufficient to use in the manufacture. We would use it in this way : The temperature in the vessel in which the fulminate is made is not allowed to rise above ninety degrees Centigrade and we have to add a little of this recovered spirit from time to time to keep that temperature at ninety degrees, and not to allow it to rise above. If we concentrate this recovered spirit we shall probably have just sufficient to use for that particular purpose.

4952. So it would not be wasted ?—No.

4953. Then as regards your proposal to be allowed to obtain your spirit in tanks, would that be a considerable economy ?—Yes. To us it would represent an economy I should say of quite £300 a year. I do not know what it would represent to the distiller. I have some figures here that might help you to arrive at some idea. The spirit comes in puncheons, and the distiller (which in the long run means ourselves) has to pay carriage on these puncheons at the same rate as for spirit. If we had a tank wagon, the railway company would only Tank wagons (*See ante* Q. 4921–7). Their use would effect economies in carriage and handling of spirit (*See* also Q. 4995–5002).

charge for the weight of spirit in the wagon. They would not charge for the wagon itself, and they would take it back empty for nothing. In that way a considerable saving would be effected. We use in a year 760 puncheons, and the carriage of these would be something like £25 for the empties only. What the carriage of them full would be I do not know. Anyhow it comes to this; the distiller has to pay for fifty-seven tons of barrels in a year at the same rate as he pays for their contents.

4954. (*Mr. Tyrer.*) That is what the distiller pays in conveying the spirit to you?—Yes.

4955. (*Chairman.*) In other words, the freight is charged on the gross?—Yes. The fifty-seven tons of casks are carried up and down, and for that he has to pay, empty and full. Then of course there is the upkeep of these casks, and the original cost of them. Against that you have the cost of the tank. I think one of the advantages of the tank would be the saving it would be to us in not having to handle 760 puncheons in the year. At present we have to unload these, roll them in, and take out the bungs. The simple handling of these barrels I reckon means quite £300 a year loss to us. If we had a tank wagon, we would simply put a syphon pipe in, and run it into the store tank, and then the tank wagon would go back to the distillery. The distiller would save a lot too, and of course we should have a share in that saving. I also think that there is another advantage in these tank wagons because with them you are not likely to have any abstraction of spirit *en route*, as it cannot be got at; you would therefore have no leakage, either of bulk or strength, which frequently happens in the case of the puncheons.

4956. The tank itself, I suppose, could be accurately gauged?—I believe so. They are used, I think to a great extent, in Germany for the carriage of spirit; at least my information is that they carry tremendous quantities of spirit in that way.

Extent and Cost of Excise Supervision.

4957. Apart from that, you pay for the attendance of the officers who come to see to the denaturing?—Yes.

4958. How often do they attend?—They attend when the spirit is received, and again at the mixing. The officer visits us once or twice in the week besides that, to see that we are not misusing it.

4959. Is he there on most days?—No. I should say that if he is mixing and taking an account in the one week he will be there probably on three days, but if he is not, he will probably be there on two days only. He then comes in to see what is going on. He walks round and goes out again; he makes no remark to anybody, but just sees what we are doing.

4960. According to your figures you must have a denaturing once a week at least?—Yes, about that. It runs sometimes ten days; he may quite escape one week.

4961. Can you remember what the charge for supervision is; it is a fixed charge?—Yes; we pay £75 a year.

Suggestion that special denaturing should be permitted at distillery or methylating premises. *See also Q.* 4981-2).

4962. That really is of much less importance to you than the other point you were discussing, namely, the carriage in the tanks?—Quite so. We hope that the Inland Revenue people will see their way to let us get this alcohol denatured at the distillery. One of my points is that the distiller or the methylator should denature this spirit on his premises. That would also effect a very great saving—not to us now, because we have gone to the expense of putting up buildings for the purpose. The buildings that we have for storing the spirit and mixing it with the bone oil and so on have, with the plant and machinery, cost us nearly £600. We cannot now save ourselves this outlay, but we think that the distiller or the methylator might be allowed to do that on his premises, instead of the consumer at the factory where the spirit is used.

4963. I take it that you are only speaking generally, and that you have not made any distinct inquiries as to whether, if authorised to do so, the people from whom you get your spirit would be willing to do the denaturing for you?—They would be delighted.

4964. Are you sure of that?—I am certain. They have big plants standing idle which they would be very glad to use for the purpose.

4965. I suppose at present they do not do any methylating?—Yes. I am referring to the Vauxhall Distillery Company in Liverpool, who are large methylators as well as distillers.

Use of Pyridine in Germany as denaturant for making fulminate of mercury. (*See also Q.* 5048-61).

4966. In your *précis* you mention that in Germany what they use as a denaturant for alcohol which is to be used in the manufacture of fulminate of mercury is pyridine bases?—Yes.

4967. Do you know in what proportion they use it?—I believe 2½ per cent. of pyridine.

4968. Surely that would be a more expensive denaturant than what you have now?—The distiller pays for that, or I suppose he does, in Germany, because they get it already denatured there and sent to the works. At any rate, it is cheap enough and it would not cost very much.

4969. The pyridine bases are becoming rather expensive now, and they are complaining of the price very much in Germany?—I was not aware of that.

Recovered spirit as a denaturant reduces yield of fulminate. (*See also Q.* 5047-8.)

4970. (*Dr. Thorpe.*) You do not suggest that you should have the pyridine bases as against the bone oil, do you?—No. What I want to suggest is that you should take out the recovered spirit and leave us the bone oil as it is; that is all. It would be very useful if you allowed the methylator or the distiller to supply this spirit already denatured, because to send recovered spirit up and down the country would be an awkward thing, but bone oil is a thing that you can always get, and he could do it on his premises quite well under supervision, the same as we do. We object to the recovered spirit simply on account of the reduction in the yield of fulminate that it gives in our experience, which corroborates the experience that we get from our friends in Germany.

4971. Still, I may point out that you have been twenty years in finding that out?—But you see we never had a pure spirit before.

4972. For twenty years you have been using recovered spirit and only just now have you discovered that it is not to your advantage to do so?—We do not get all the advantage of pure spirit with recovered spirit. Directly you gave us pure spirit we wanted to take the best we could get out of it, but previously we had to do the best we could.

4973. (*Mr. Nicholson.*) If you were to concentrate that recovered spirit to a high strength, would the same objection to its use be apparent?—You would not have it to use then.

4974. Do you mean that you would not have sufficient for the 10 per cent?—Yes.

4975. So far as it went would there be any objection?—There is always an objection to this recovered spirit, because it is not absolutely pure spirit—it contains impurities.

4976. Even in a concentrated form?—Yes. You do not remove those impurities really; you only get rid of the water.

Efficiency of recovered spirit in preventing misuse by workmen.

4977. (*Dr. Thorpe.*) May I remind you that when you came to us to discuss this question it was practically your own suggestion that you should put in the recovered spirit? You pointed out to us that the real advantage in using recovered spirit was that the stuff had got so bad a name within the works that you were absolutely certain that no workman, or anybody familiar with the manufacture of fulminate of mercury, would ever think of drinking any alcohol in which there was a sensible proportion of that recovered spirit; and that as a matter of fact it was the very strongest protection that the Revenue could have against the illicit use of such spirit. Was it not on that ground that we rather gave way and fell in with your suggestion of using that material?—Yes, that is so. When I said that recovered spirit would prevent anybody drinking it, that was so. They have a very great horror of that stuff and the smell of it.

4978. (*Mr. Tyrer.*) Is their objection sentimental, then rather than real?—They really have an idea that if they were to drink that spirit it would produce fulminate inside their stomachs and blow them up. That is the idea they have, and we encourage it. Whilst I admit that the recovered spirit was a good thing to put in to prevent them drinking it, I say that a small percentage of bone oil is a great deal better. You might possibly get some man who would say, "Now go and drink that;" I have

Mr. G. Smith
1 Feb. 1905.

never known a case of it, but I am perfectly certain that he would not take alcohol with bone oil in it. That is a sheet anchor.

4979. (*Dr. Thorpe.*) I must remind you that it is not difficult to remove the bone oil?—It is difficult for the ordinary workmen, I should say; they have no means of removing it.

4980. Is not bone oil a very insufficient security?—It is a security so far that when a man wants a drink he nas no time to remove it, or if he wants a drink and takes that stuff, it will pretty soon remove the contents of his stomach I should think.

Denaturing at distillery or methylating premises (*See also* Q. 4962-5.)

4981. You suggest to us now in effect that this denaturing with what you now ask for, namely, bone oil to the extent of four fluid ounces to the hundred gallons, might be done at the distillery or at a methylator's, and that the denatured stuff might be sent to you. Surely the Revenue would not be very well protected under those circumstances? When the spirit is in transit, of course there will be opportunities for considerable leakage and abstraction, and if any sensible proportion of that spirit did get abstracted, it is not at all impossible to get out a minute trace of bone oil, or to reduce its noxious character to such an amount that the spirit may become potable?—You mean that it would be abstracted by someone who knew what to do; you do not mean that it could be done by workpeople?

4982. No, it must be extracted by somebody who knows how to do it?—Does not that apply equally to the present condition of affairs where you have absolutely pure spirit coming in puncheons? Anybody may abstract that and they do; that is well-known. Whereas, here is this stuff, and how a man is going to abstract it out of an iron tank I do not know—that is supposing you allow us the iron tank. He cannot bore a hole in it very well. But suppose he does get it out, I think he would get rather a shock if he tasted it; he would not think that was spirit.

Pyridine preferred as a denaturant to bone oil. (*See also* Q. 5003-11 and 5049-61.)

4983. (*Chairman.*) You would not prefer the pyridine bases to animal oil, would you?—I do. The Inland Revenue people thought the other was far more obnoxious, and they stuck to it.

4984. Would you strongly prefer the pyridine base?—No, not strongly. I would prefer it myself; but I think your point of view has to be considered. I do not want to be grabbing everything, and I think if you feel more certainty with the bone oil, you should keep it; it is bad enough.

4985. Supposing we were to double the quantity of bone oil and omit the recovered spirit, would that seriously interfere with your manufacture?—No, I would not object to that.

Suggested allowance on export of fulminate of mercury.

4986. There is one other suggestion you wish to make, I understand, as regards the fulminate of mercury which is exported. You suggest that on the fulminate of mercury exported you should be given an allowance calculated on the amount of proof spirit destroyed in its manufacture, so as to give the fulminate of mercury the same benefit that the proof spirit so destroyed would have received itself if it had been exported?—Yes.

4987. How much alcohol would be consumed in making a pound of fulminate of mercury?—A gallon and a quarter of proof spirit.

4988. Do you do a large export business?—It is nearly all exported—not in the shape of fulminate as fulminate, but in the shape of fulminate mixed with chlorate of potash compressed into copper tubes known as detonators. We do, however, export fulminate in bulk, but most of it goes abroad in the shape of detonators.

4989. How, as a practical matter, would you propose to make this proposal of yours work in respect of these detonators?—The composition of all classes of detonators is well known from No. 1 up to No. 8 or 10, as the case may be. The percentage of fulminate and chlorate in detonator composition is eighty of fulminate to twenty of chlorate, with the exception that when the detonators are meant to be converted into electrical fuses, the composition then is about 90 per cent. of fulminate and 10 per cent. of chlorate. So that you know for every class of detonator the weight of the composition per 1,000.

4990. Do you yourselves make these detonators?—Yes.

4991. Therefore, the whole of the article exported is manufactured from beginning to end in your works?—Yes, under my charge. Last year we made 52 millions, a great proportion of which we sent abroad to compete with our German friends.

4992. If the greater part of your manufacture goes abroad, the proposed allowance would represent a considerable sum to you?—Yes.

4993. It would represent well over £1,000 a year, would it not?—Probably more than that—nearer £2,000, I should think.

4994. That would be a nice addition to the receipts of the company?—Of course, we consider ourselves in this respect in the position of exporters. An exporter of spirit, I understand, would get that allowance on its going abroad. We export spirit in this particular form, and why should not we have it?

Tank wagons (*See ante* Q. 4921-7 and 4953-6.)

4995. (*Mr. Tyrer.*) Your preference seems to be on all grounds for tank conveyance from the methylating warehouse to your place?—Yes.

Security of against abstraction.

4996. That, you say, would be comparatively easy in the case of your suppliers, because they are already methylators?—Yes.

4997. I think I heard you say that spirit when conveyed from the distillers to you was now more or less abstracted?—I did not say to us, but that it can be. I do not think we have had a case.

4998. Do you not think—I am bound to say I do—that a tank containing, say, 600 gallons, would be far safer than six puncheons of an equal aggregate capacity?—Yes.

4999. From the point of view both of waste or leakage and of possible damage and accessibility?—Quite so.

5000. I do not know what the German practice is, but I suppose there would be no objection on the part of any person to protect the Revenue by putting Revenue locks upon the tanks?—No. That is what they do in Germany; and they put a seal over them too.

5001. I gather you think there would be no danger then, whatever the route?—I should think there would be less danger than at present.

5002. And this Revenue protection would not interfere with you in any way?—No, I should not think so.

Relative efficiency of bone oil and pyridine bases in preventing misuse of spirit by workmen.

5003. Your preference is for bone oil as a denaturant, is it not?—Bone oil or pyridine.

5004. Do you think your people would be more alienated from the possibilities of tasting the stuff if it were bone oil than if it were pyridine?—No, I do not think so.

5005. It is almost impossible to keep a secret, and if somebody said, "This has got pyridine in it," they might smile or laugh at it, but the very name "bone oil" would be enough almost to throw them off. What do you say to that?—I think with bone oil they would not try, but they might perhaps with pyridine, because it looks a nice clear liquid and would suggest to the lay mind that it could be got rid of. Bone oil is a very thick liquid, and of the two, I think the feeling would be that you could not remove the bone oil, but that you might remove the other, and that the other is so innocent looking that you might possibly drink it without ill effects.

5006. (*Chairman.*) It does not smell innocently?—No, but it does not smell so villainously as bone oil.

5007. It is pretty nasty, is it not?—It is, and it has a very peculiar effect on the tonsils and on the glottis. I have never tasted spirit with pyridine in, but I have tasted it with bone oil, and it is simply horrible.

5008. (*Mr. Tyrer.*) At any rate it has satisfied you that it is nauseous enough?—Yes.

5009. In view of some of the questions which have been asked by Dr. Thorpe, would double the quantity of bone oil be in any sense of the word a serious matter to you?—No, I do not think it would. I have never made the experiment, but I should not think so. The only objection that there is to bone oil as bone oil from our point of view is the peculiar smell that it has which makes the men sick. They feel sick and cannot take their food; the whole atmosphere is permeated with it.

5010. They get used to all sorts of things; have they not got used to that?—Unfortunately a lot of them will not get used to it—they leave their work rather. It is very nasty.

5011. That is a point worth knowing?—Yes; and it really keeps them off any idea of tasting stuff that smells like that. It is bad enough in all conscience.

Treatment and character of recovered spirit.

5012. With regard to this spirit which has hitherto been recovered, what would you do in case the alternative which was referred to by Dr. Thorpe was adopted; what would become of this spirit which would have to be recovered in that case?—The spirit would be concentrated, and in that way we should not get above half the quantity we do now; and all we got would be required for regulating the temperature of the reaction in the balloons in which the fulminate is made. We use a fair amount of it for that purpose.

5013. You have tried experiments of concentration in the laboratory, of course?—Yes.

5014. May I ask whether in the form of concentrated or rectified or strengthened recovered spirit, it is as objectionable, or whether it will need any addition of bone oil?—They would not care to let us start with pure spirit; you must have bone oil in to start with.

5015. With regard to the recovered spirit that you distil off and then propose to concentrate, do you think that its odour, taste, and the other preservatives of the interests of the Revenue from a potable point of view, would be sufficiently maintained by its rectification or concentration?—Yes, they take good care of that, for they come and put more bone oil in.

5016. (*Dr. Thorpe.*) I think perhaps you had better inform Mr. Tyrer what is your method of recovering. To begin with, you treat the recovered spirit with lime, do you not?—Yes.

5017. You practically use the free acid and you also destroy certain compounds by means of the lime; then you subject it to distillation?—Yes.

5018. So that it is a rather clean spirit, I will not say an absolutely clean spirit, but a spirit which is considerably purified?—Yes. I do not know whether you get rid of that bone oil; you do not get rid of the smell, but whether you actually get rid of any of the oil in the mixture I do not know. However, that point is secured because they put more in—so it is all right.

5019. From time to time you let us have samples, or we get samples of the material, so we know what it is like, and we know that it is very different from the original spirit?—Still you find some bone oil left in, do you not.

5020. Very little, and it stands to reason we should not. If you have been treating it with these acids you have got rid of a large quantity of the nitrogenous bases in the bone oil which give the bone oil its peculiar flavour?—That would be so.

5021. (*Mr. Tyrer.*) The interests of the Revenue are preserved by the addition of an extra quantity of bone oil?—Yes.

Commercial result of concession under Finance Act, 1902.

5022. For several years you have been able to use methylated spirit in the old form?—Yes.

5023. And you have been able to compete?—In a way.

Saving of 4d. a lb. effected.

5024. But since the present concessions I presume you have been able to do much more business?—We have done more business, but that is probably not due to the concession. It is due to the fact that there has been an extra run of work on account of the mines in South Africa being suddenly opened with this Chinese labour, which has called forth great demand for detonators, which we have been able to get into the market; even the Germans could not get there quick enough this time. That really accounts for the greater demand for detonators just now, and since this concession was given.

5025. So that from the manufacturer's point of view unfortunately your present state of business with this rather abnormal demand arising out of peculiar circumstances is not due to the concession?—No; I think you could hardly say that. There has been a sudden call for explosives all over the place on account of the opening of these mines.

5026. I will put my question in another way, because I want to see exactly where the advantage comes in. I am a manufacturer myself, so I sympathise with you from that point of view. Were you able, up to the point at which you got concessions for a purer spirit denatured suitably for your work, to compete with the Germans as well as you are able to compete with them now?—I could not answer you that question, because I am not in the commercial department at all. *Mr. G. Smith* 1 Feb. 1905.

5027. Still you know, as you have just told us, that you made the enormous quantity of 50 millions of detonators having a high percentage of fulminate, and we have also had the fact that a pound of fulminate requires a gallon and a quarter of spirit, which means, as you yourself have admitted, a considerable saving to you. Therefore I want to see whether by the old method of doing things you were seriously inconvenienced in competition with the Germans?—Of course there has been an improvement in prices, and there was bound to be, simply from the use of the pure spirit as compared with the methylated spirit. I think we save something like 4d. per lb. by the use of pure spirit.

5028. Do you mean that the saving in materials is equal to 4d. per lb. of fulminate?—Yes.

5029. What is the market price of the fulminate?—The market price is about 6s. 6d. I should think, as near as possible.

English Competition in fulminate of mercury.

5030. Were you seriously inconvenienced by the competition (which I have heard or read somewhere has ceased) from the Channel Islands?—No, not specially. The Channel Islands man took all the Government orders, and we were inconvenienced in that way; we did not get any of them. There was no outlet in that direction.

5031. That has now stopped, has it not?—No, he is making in this country now—in Faversham, in Kent—so he is still an active opponent.

5032. Under conditions equal to those in the Channel Islands?—No, under the same conditions I presume as we are, being under the Inland Revenue authorities here. He was not under anybody there; he was a law unto himself.

5033. But he is under the Revenue authorities here?—He is bound to be.

5034. Do you know as a fact that he is?—I do not know anything about him really, but I think he cannot be anything else. Is that not so, Dr. Thorpe?

5035. (*Dr. Thorpe.*) Obviously he is under the Revenue authorities, and he does exactly what you do. These people down at Faversham are treated exactly as you are, and there is no difference between you?—Then in this particular case he is under the same conditions now that we are, but when he was in the Channel Islands he was under no conditions whatever, and he practically used pure spirit.

Excise Supervision (*See ante* Q 4928–34).

5036. (*Mr. Tyrer.*) On the question of supervision your only grievance, if it is a grievance, is, as I understand it, that there is perhaps not sufficient expedition from your point of view. As I understand you, the spirit comes in in the day time. Of course one can easily understand that if it came in at four o'clock in the afternoon, or at five o'clock in the afternoon, it would be rather awkward to begin denaturing then?—They would not do it then; they are not allowed.

5037. But are we to understand that if it comes in, say, at eight o'clock in the morning, the officer does not attend, and that the work cannot go on that day because he leaves it to the next?—He takes an account of it, but, I believe, according to the regulations he is not supposed to mix that day; he comes another day for that.

5038. I am not familiar with the minute details of the arrangement. Does it not appear to you that the interests of the Revenue are more effectually conserved if, assuming that there is a remainder of the day sufficient for the denaturing, he can proceed at once?—Yes, but they have their rules.

5039. The calculated expense of the officer to the Board of Inland Revenue depends on the time given; so that if you could save three days' work in the fortnight you would, to some extent at any rate, show cause why those three days should be allowed to you, as during that time saved the officer might be doing work elsewhere?—Quite so.

Mr. G. Smith
1 Feb. 1905.

5040. There should be a saving in that direction, in the same way as you point out that the freight on the empty casks adds to your cost about £300 per year?—Yes. If you denature at the distillery you will get rid of that officer's salary altogether.

5041. Have you to send the empties back at your own expense?—No, they go back at the distiller's expense, but we pay for it, of course, in one way or the other.

5042. (*Dr. Thorpe.*) Are you limited as to the amount that you may denature at any one time?—I think not, but the vat, of course, will only hold so much. The whole thing has been arranged to denature 2,000 gallons at a time.

5043. Do the Excise authorities require you to denature a minimum quantity of, say, at least 500 gallons?—Yes, I think they do.

5044. Is the officer single-handed?—No, the supervisor comes with him.

Effect of denaturants on yield of fulminate. (*See also* Q. 4970–6.)

5045. (*Sir William Crookes.*) There is one little point I do not quite understand. In the first place, supposing you were to have quite pure alcohol without bone oil, would you get a better yield?—Yes.

5046. Then the bone oil does do some harm?—Yes.

5047. You say in your proof that the use of recovered spirit reduces the yield; is that recovered spirit the spirit which is recovered from a previous operation, and by reason of that has not so much bone oil in it, or is it the recovered spirit after the addition of the extra bone oil?—It is the recovered spirit after that addition.

5048. Then, although you can work and get a satisfactory yield with bone oil, you would prefer to have no bone oil?—Yes, but this result, of course, would be got with absolutely pure spirit. It makes a difference calculated out on the year of some fair amount. For instance, we make 500 pounds odd of fulminate per day, and, according to the experiments that we were able to make with pure spirit, if we use absolutely pure spirit, or even perhaps spirit with a little bone oil in it, not more than we have got now, but eliminating the recovered spirit altogether, we should be able to make with that something like five pounds of fulminate more every day. At five days a week that would be twenty-five pounds at 6s. per pound, which comes to something considerable in the year. That is what our German friends have found out, and so, of course, they do not use it.

Pyridine as a denaturant. (*See also* Q. 4966–9, 4983–5, 5003–11.)

5049. (*Mr. Tyrer.*) But they do use denatured spirit?—Yes, they use pyridine, and pyridine only.

5050. If you had pyridine under even slightly severer restrictions, would you be able to obtain those results?—Yes.

5051. (*Sir William Crookes.*) Does pyridine interfere as much as bone oil with the manufacture of the fulminate?—We have never tried pyridine, because we have never been allowed to use pyridine on anything like a scale sufficient to give results that are worth having.

5052. But it would be an advantage if you could be allowed to have some denaturing agent which was just as horrible in its taste and smell as bone oil, and would have no effect whatever on the yield?—Yes, it would be an advantage. As far as one knows, bone oil seems to answer the purpose required by the Revenue, and supposing they took out the recovered spirit and did not increase the bone oil abnormally, I should say that was the best thing to be done.

5053. (*Mr. Tyrer.*) Except that you would like to save the five times 6s. each day?—Yes, I want that.

5054. (*Dr. Thorpe.*) May I point out that, after all, the amount of bone oil is only 0·025 per cent.—that is to say, instead of using 100 per cent. alcohol you are using 99·97 per cent., or something like that?—That is so.

5055. (*Mr. Tyrer.*) It is certainly a remarkable result that you should get five pounds less per day, and therefore you have a very excellent case from an economical competitive point of view for having an alternative?—Yes.

5056. But, of course, there are the considerations which the advisers of the Inland Revenue have referred to?—Yes.

5057. (*Mr. Nicholson.*) I understand you do not attach so much importance to it that you have applied to the Board of Inland Revenue to be allowed to use pyridine bases in exchange for the bone oil?—No, I think they are quite pleased with the bone oil.

5058. Are you?—No, they are. I would rather they would take out bone oil, and give us the same amount of pyridine; but I know it is no good going to them with that proposal, which they would think most alarming. They prefer this bone oil, and I say, "If you feel comfortable with bone oil, all right—continue it; it is bad enough and if you will take out that recovered spirit, and double the bone oil, I will not fall out with you, but do not do more than double it."

5059. (*Chairman.*) My recollection is that the bone oil was your own suggestion?—I wanted pyridine, but I think Dr. Thorpe thought it was far too much of a perfume, and that he would have bone oil. He said he felt more comfortable with bone oil.

Increasing cost of pyridine an objection to its general use as a denaturant.

5060. (*Dr. Thorpe.*) You would be the first to cry out in six months if we let you have pyridine, for the reason that pyridine is going up rapidly in price, because there is a direct demand for it apart from any denaturing. A number of rather valuable things are now being prepared from pyridine, and pyridine is rapidly occupying the same position with respect to synthetic products that benzol has hitherto done. It is the nucleus of a large group of synthetic perfumes, and in consequence of that commercial demand its price is going up very considerably. The Germans are becoming very alarmed about the possibility of it. In fact, the one thing which they took umbrage at, or, at all events, got excited about, when we went over to Germany was the possibility that we were going to use that same thing ourselves, and therefore that we were going to still further enhance the price of it. This is the one thing they deprecated our doing, privately. They themselves are continually asking their own Government to abolish it, and they want to get rid of it. The ideal denaturant is a thing which is otherwise worthless, which does not do anybody harm, so to say, as regards its manufacture; which can be got for next to nothing; and which is practically a waste product. Bone oil to some extent is a thing of that order, but pyridine is now becoming a very valuable article, and therefore I should very strongly deprecate advising the Board of Inland Revenue to take over pyridine as one of the general denaturants to be used, because we should certainly have to undo it quickly. I should like to read you this translation from the official German report on duty-free spirit for the year ending the 30th September, 1902–3: "Whilst wood naphtha suitable for denaturing purposes seems likely to be produced in quantities equal to all probable requirements, there is some fear of a scarcity of pyridine bases. This possible scarcity is due not only to the increasing use of the pyridine bases in the general denaturing mixture in our own country"—that is, Germany—"and in foreign countries, but also to the other technical uses to which these bases are being applied, as for example in the purification of artificial indigo, and its by-products, and in the production of brom-indigo. On the other hand, of the known sources of pyridine bases, coal tar, shale oil, brown coal tar, and bone oil, until now only a portion of the coal tar of the gasworks and coke ovens has been really systematically worked for these bases. However this may be, wood naphtha can at present be bought in large quantities wheresoever required in Germany for about M. 70 per 100 kilogrammes"—that is, about 2s. 8d. per gallon—"whilst the price of pyridine bases is continually rising—its average price for the last year is almost M.137 per kilogramme, and it has since risen." What do you say to that?—We had better keep off that. I think we had better stick to bone oil. However, in response to some inquiries I made I was informed that certainly at one works in Germany 2½ per cent. of pyridine base was used. I have the answers to my inquiry here (*handing in papers*).

5061. (*Chairman.*) I do not find in the German regulations any mention of the 2½ per cent. of pyridine base as an authorised form of denaturant; and it looks very much as if in this factory which you quote the spirit is denatured with 2½ per cent. of an agent consisting of four parts of wood naphtha and one part of pyridine bases?—That would appear to be so.

Mr. RICHARD FRANCIS NICHOLSON, called, and Examined.

5062. (*Chairman.*) I believe you are one of the managing directors of J. & W. Nicholson & Company, distillers and Rectifiers, working in London ?—Yes.

5063. Where are their works ?—The particular works for the purposes of this Inquiry, that is the distillery, is at Bromley-by-Bow, West Ham.

5064. Do you manufacture both for consumption and for methylation ?—Yes.

Manufacture of spirit for methylation. Such spirit is of different quality to spirit produced for drinking, and is made at present mainly from molasses. (*See* also Q. 5136–8 and 5151–2.)

5065. Do you do any considerable amount of manufacture for methylation ?—Yes, a very large trade.

5066. Is the spirit that you produce for methylation substantially the same as that you produce for consumption ?—Substantially.

5067. Do you use different materials for it ?—At the present moment we are using a different material, but at any moment we might be forced to use the same.

5068. Distilleries that produce only for methylation I understand generally use molasses, or very largely use that material; is that so ?—At the present moment that is fairly correct; approximately three-quarters of the spirit which goes for methylation is produced from molasses.

5069. Is that the cheapest material to produce from ?—At the present moment it is.

5070. Has the price of molasses been affected by the price of sugar ?—It has risen rapidly.

5071. So that it might at any moment cease to be the cheapest material ?—It might be ruled out of the market by price.

5072. Do you want different plant to distil from molasses ?—You do not use quite as much plant in the manufacture of the spirit from molasses.

5073. Could you use the same plant sometimes for molasses and sometimes for starchy substances ?—If I may put it in this way—all the plant that we use for molasses we use in the manufacture of grain spirit.

5074. The spirit that you produce for methylation could be used for consumption, I suppose, without being rectified, although it would have to be compounded ?—It would be potable, although it would not be desirable to use it for consumption.

5075. Then the spirit that you produce for methylation is a less pure spirit than that which you produce for consumption; does it contain impurities that are absent in the latter ?—It is not such a stable spirit, and it would be liable to oxidation.

5076. Before you set to work to distil, do you have a clear intention of producing spirit for consumption or spirit for methylation, or may you use your spirit when produced according to the circumstances of the market for either one or the other ?—There is nothing in the law to prevent you using it so, although I should say it certainly is not the custom to use it for either purpose.

5077. In fact your proceedings would be different, or the materials that you use would be different, if you were going to manufacture spirit for consumption, from what they would be if you were going to manufacture spirit for methylation ?—I am afraid I do not quite understand your point.

5078. When you start a course of distilling, do you always know beforehand what you are going to do with the spirit when you have made it ? Do you proceed differently if you are going to make spirit for drinking purposes than if you are going to make it for methylation ? I understand that in one and the same distillery you sometimes make for consumption and you sometimes make for methylation ?—We make for both in the same week.

5079. And in the same building and with the same plant ?—Yes.

5080. But always before you start your brewing and the subsequent distilling, you know what you are going to do with the spirit ?—Yes.

5081. You know the purpose for which you require the spirit ?—Yes. We are working with different material for the two purposes.

Mr. R. F. Nicholson.

1 Feb. 1905.

5082. Is the one spirit more cheaply produced than the other; is there any substantial difference in the price ?—At the present moment owing to the price of molasses over the world being low, it is a cheaper material than grain, and so the spirit is cheaper.

5083. What proportion of the cost of producing spirit may you put down to the actual materials; would it be one-half ?—That would be very vague, because roughly speaking the working expenses would be the same from year to year, and the fluctuation in the price of the spirit would be due to the fluctuation in the price of the materials. In the case of molasses we have sometimes given more than three times the price for the same article within a year or two.

Fluctuations in selling price of plain spirit. (*See also* Q. 5144–5)

5084. Does the price of this plain spirit in the market vary much ?—Yes, it has fluctuated a good deal. In the last fifteen years it has fluctuated within a margin of 30 per cent. In the case of spirit for methylation there is a still larger margin, and I have known it fluctuate within 50 per cent. per proof gallon.

5085. Taking the prices at the present moment, what is a fair average price per proof gallon for spirit for methylation ?—The price in London to-day is 10d. per proof gallon.

5086. That would bring the bulk gallon up to about half as much again ?—Up to 16d. odd.

5087. Speaking within the last fifteen years what has been the highest price that you remember for that class of spirit ?—1s. 3d. per proof gallon.

5088. Do you work pretty continuously throughout the year at your distillery ?—Yes, continuously.

5089. Do you work your plant to the full power, or should you, if there was a sudden and largely increased demand for spirit for industrial purposes, have any difficulty in increasing your output ?—We should have no trouble in producing more.

5090. Then you could produce more ?—If wanted.

Cost to distillers of Excise restrictions.

5091. Only experts could go into the details, but I want to ask you one or two quite general questions as regards the effect of the restrictions under which you work; I do not propose to make any attempt to value them; I want to get from you some general remarks as to the restrictions under which you work and the extent to which they affect you. As you know we make an allowance on the spirit exported in virtue of the fact that we admit that the restrictions of the Board of Inland Revenue do increase the cost of manufacture very considerably. Could you tell the Committee what the particular things are which principally lead to that increase of cost; for example, let us begin with the plant and buildings; is there any increase of capital imposed by our requirements ?—The plant and buildings are unnecessarily large for the production of the spirit owing to the Excise restrictions—many times larger than they need be.

Larger capital outlay for plant and buildings

5092. Let us take your own distillery; would your own distillery cover less ground and contain less buildings and a smaller quantity of plant it you were working absolutely free from all restrictions ?—It would, certainly. Some years ago I went to see some distilleries in America where they worked under a certain amount of restriction. I went to one which was turning out more than three times the amount that we are producing at Bromley, and I found it was a very, very small building and plant.

5093. Are their restrictions very much less severe than ours ?—Very much less.

5094. What are the points in which they differ principally ?—Brewing and distilling can go on at the same time; they have absolute discretion in mashing, and as far as I could see there was very little evidence of Excise officers about the place.

5095. And I suppose as far as you could see there was very little security for the Revenue ?—Very.

Mr. R. F. Nicholson.

1 Feb. 1905.

Existing restrictions on working considered fair as a whole, and not more than is necessary for protection of Revenue. (*See* also Q. 5186–8)

5096. Looking at the matter quite impartially, are there any of our restrictions that you think unnecessarily severe?—I think all the Excise restrictions have been put on to meet particular points which it was necessary to protect. Although in certain cases the incidence of the restrictions affects individual distillers differently, yet, as a whole, they are a very fair set of restrictions indeed. They certainly protect the Revenue to the utmost.

5097. And that, with the duty at its present amount—? —Is absolutely necessary.

5098. Let us take the one which, after all, I believe is considered to be the most onerous, or at any rate to be the one that perhaps contributes most largely to the increased cost of production; that is, the separation of brewing and distilling. Is there any conceivably satisfactory check that could be invented apart from that; has it ever occurred to you that the same result might be obtained in any other way?—I do not know how you could bring it about, but any other form would certainly largely increase the expense of the collection of the duty.

Separation of brewing and distilling periods.

5099. It would?—Distinctly. You have an absolute check at the present time.

5100. The result of the separation of the two processes is this, is it not, that half your plant, either the brewing plant or distilling plant, is always idle?—Yes, and as the two are not equal it means more than half of our plant in hours of work.

5101. As a matter of fact, how is the time as a rule divided? Take a week in the distillery, are you three days brewing and three days distilling?—In our own particular case—and I can only answer for that—we are distilling for two days and we are brewing for the four following days in the week for the next period.

Interruption of work on Sunday.

5102. Is the interruption of work on Saturday night till Monday morning a serious drawback?—It is a very serious expense. It means a great deal more coal and prevents the work being continuous.

5103. Should you have any difficulty in continuing over the Sunday if it were not for the Excise regulations? Would the labour question make any difficulty, or could you get sufficient attendance on Sunday without much difficulty?—I think there would be no difficulty in that.

5104. I suppose for the distilling part you do not require very much attendance, do you? The machine itself goes on working without the presence of many men?—I should think roughly from a half to two-thirds of the men employed during brewing would be employed when distilling.

5105. On the Sunday?—Yes.

5106. And for the whole day?—If we were working absolutely without Excise restrictions, the distilling operation would go on continuously the whole week, the whole seven days and nights.

5107. Would the two operations always go on concurrently?—Yes, always in proportion to one another.

5108. You would have to keep up the one in order to supply the other?—Yes.

Allowance of 3d. per gallon on Export not regarded as adequate to cover cost of restrictions.

5109. Do you do much exporting business?—A very fair proportion.

5110. Do you consider that the allowance which we make of 3d. per proof gallon on the plain spirit covers you?—The 3d. allowed for export is very insufficient. We have no chance in a neutral market, and it is only, generally speaking, where British spirit is asked for that we can get a chance of competing.

5111. In what form does your spirit go abroad—as a plain, silent spirit?—Yes.

5112. Then at the present price of the spirit, 10d. per proof gallon, the allowance of 3d. is based on the assumption that 30 per cent. of the cost of production is due to the Excise restrictions, in other words, without the Excise restrictions you could sell that spirit at 7d. which is now sold at 10d.?—Yes. The special methylation spirit is sold at 10d.

5113. Therefore one may assume on the basis of the existing figures, roundly, that the cost of production is 9d. and that of that 9d. one-third is due to the Excise restrictions?—Yes.

5114. In other words, without the Excise restrictions you could produce at 6d. per gallon?—Certainly.

5115. You have no doubt about that, have you? You think you could produce at 6d.?—I certainly think we could. The Excise restrictions trouble us in so many more ways than are recognised by the Excise. The Excise, in the differential duty, give us certain money value for certain prohibitions, but there are many more prohibitions which they will not acknowledge; for instance, we cannot work by-products as we should like to do, owing to the restrictions. We cannot work kindred trades in conjunction. For instance, we might be sugar refiners or starch makers, or other kindred trades. We are cut off entirely from that. We are put into a category by ourselves simply as distillers. These restrictions, therefore, tell very much against us. Also, whenever we apply for an alteration in plant, plans have to be produced and reasons given why we are going to do it; if the Excise do not like the scheme we cannot carry it out. We have to satisfy them as to its chances of success. It is very hard indeed for a distiller to try experiments to improve his produce or plant. There are many things of that kind. Besides, owing to being under supervision, no secret process whatever can be worked, because the information leaks out and is passed on to other distilleries. In most free trades money is made by enterprising people working their own schemes in their own way, but we are absolutely debarred from doing so. In fact, by the rules and regulations there is virtually only one way to make spirit—you have got to brew and use certain vessels and you have got to distil and use certain stills, and the whole thing has got to be followed out in a certain way. Therefore the values that have been agreed upon as a compromise between us and the Excise by no means represent the whole case.

Certain restrictions not taken into account by the Excise in fixing the Surtax.

5116. Do you imagine that if you were perfectly free the form of your plant might be different from what it is?—Yes, I think that we should make many alterations. We very often have to use more vessels than are necessary, so that the Excise could take dips and measures and surveys. We should work much cheaper in that way, and not have to move our material about so much. There are many ways in which we might economise if it were not for the Excise.

Restrictions on removal of yeast.

5117. Do you find that the restriction upon the quantity of yeast that you may abstract is a burden?—Our distillery is not manufacturing yeast for the market, so I cannot speak on the question.

5118. Do you not sell any yeast?—No.

5119. That particular restriction tells most heavily upon the yeast distillers?—Yes; but we do not find the penny offered as a compensation sufficiently inviting for us to go into the yeast trade.

5120. A distillery must be either distinctly a spirit distillery or a yeast distillery, and it must regard one or the other as its principal product, and keep to it, must it not? Does not a yeast distillery aim at getting as much yeast as it can, neglecting the spirit?—I think that is generally true, but it would, of course, depend upon the relative price of yeast and spirit.

5121. Still, there is the advantage of the continuous demand for yeast which must be satisfied; I suppose they always have a good market for it, and that bakers like it fresh; is not that the case?—I know nothing about the yeast.

5122. Because you do not sell any?—That is so.

5123. Are you yourselves methylators?—No.

5124. I see in your *precis* you suggest that a smaller proportion of wood naphtha might be used as a denaturing agent; have you any special experience as regards the denaturing of spirits?—No, that was merely a suggestion for cheapening the finished article, because I understand that in some previous Commission it was put forward that a much smaller percentage of naphtha would be sufficient to render it unpotable.

5125. However you do not speak of that with any special knowledge of your own?—No.

5126. One suggestion that has sometimes been made is that the manufacture of industrial spirit should be treated as something quite separate from the manufacture of potable spirit; is that a practical suggestion?—I do not

Manufacture of industrial alcohol in separate distilleries not regarded as practicable

see how it possibly could be carried out. If some spirit were to be produced under a lax administration of the restrictions which are considered necessary for the protection of the Excise, I am afraid there would be a good deal of trouble.

5127. After all, the so-called industrial spirit as you have already told us is either fit or could very easily be made fit for drinking ?—Yes, certainly.

5128. At most it would require rectification ?—Yes.

5129. And then you would have a perfectly potable spirit ?—Yes.

5130. Therefore, supposing you had a system under which industrial spirit was made in special distilleries, which would be allowed only to produce industrial spirit and to sell it only for industrial purposes, you really would have to watch that spirit from its place of manufacture until it reached its final destination ?—Yes.

5131. It would have to be earmarked all through ?—Yes.

5132. It might to some distillers be embarrassing, might it not, to be deprived of the means of getting rid of the surplus spirit which they might have ? Supposing a man had a distillery in which he was manufacturing for consumption, and supposing that he has over-produced; at the present time he can get rid of the surplus for methylation if he chooses, but that would be prevented if you separated the two ?—I do not see how they could be separated.

5133. I am assuming that they are separated, as I am now wanting to see exactly what the objections are to separation. There is an objection as regards the industrial distillery, that you have no sort of security that the spirit produced might not be made potable, and therefore you would have very carefully to watch over that, and that watching would add to the cost of production ?—Yes.

5134. Then, on the other side, you would have certain distilleries that were to produce only for drinking purposes, and under such a system as we are imagining there would be this great disadvantage to them, that, if they had a surplus of spirit for drinking purposes which they might under some other system dispose of for industrial purposes, they would not be allowed to do that, because they manufacture only the other sort of spirit ?—The restriction would be a further hardship.

5135. I suppose at the present time it might very easily happen that a maker of patent spirit may very often find it convenient to sell some to a methylator instead of selling it to a gin distiller or something of that kind ?—I believe it is done sometimes.

Tendency to use less molasses and more corn in making industrial spirit. (*See also* Q. 5151–2).

5136. (*Mr. Nicholson.*) Some years ago we used frequently to do that with spirits not quite so good; the last runnings from the stills, for instance, were got rid of in that way, by being sold for methylation. I understand you anticipate that the use of molasses will gradually become less ?—I think so, owing to the improved knowledge of chemistry. The refiners certainly get more out of their material than they used to get; molasses certainly contain less quality now. We see that to a marked degree.

5137. And the tendency also, I rather gather, is for the quality of the methylated spirit to be better ?—Distinctly so; buyers are more critical.

5138. If this Committee were to recommend further facilities to be given, and if ultimately further facilities were given for its industrial use, that again would make the quantity of spirit made from molasses smaller in proportion; that is to say, if a larger quantity of spirit were used for industrial purposes, as the quality of molasses became decreased the proportion of spirit made from corn for industrial purposes would be increasing ?—Certainly it would.

Potatoes as a source of spirit a more expensive material than grain.

5139. There have been several witnesses who have put forward the view that if only they had as cheap spirit as is obtained in Germany they would be able to do much better, and they have assumed that the cheapness in Germany was due to the use of potatoes. I should like to get from you what your view is as to the cheapness of potatoes as compared with maize ?—If potatoes were cheaper than maize we should use them. But in the first place potatoes contain a very much smaller percentage of starch than maize, there being something like 20 per cent. in potatoes and 65 per cent. in maize. Then with corn, there is a residual product called grains which are sold to cow-keepers and bring in a good deal of money. As far as I understand the brewing of potatoes, the residue is worth very little for the same purpose. Further, the cost of preparing for brewing and of brewing potatoes containing so much less starch would be in proportion a good deal higher than the cost of brewing from maize.

5140. So that altogether it is an entire fallacy to suppose that potatoes are a cheaper material than either maize or any other cereal ?—It is certainly a fallacy in this country, and many distillers suspect that it is really a fallacy abroad, as we understand that various of the German distillers have petitioned their Government to allow them to brew from corn instead of from potatoes.

5141. (*Chairman.*) Could you name a price per ton for potatoes which would induce you to use potatoes ?—Potatoes vary tremendously, as you know, of course.

5142. What is the most that you could afford to pay for a ton of potatoes in order to enable you to produce spirit which you could sell at 10d. per proof gallon ?—I could not tell you exactly, but I think it would have to be well under a sovereign per ton to make it worth while.

5143. (*Mr. Nicholson.*) May I put it in this way: Dr. Markell, the German authority on distilling questions, states that potatoes on an average contain 20 per cent. of starch, and by a process of deduction he arrives at the fact that some 83 per cent. of that 20 per cent. is convertible into spirit; therefore potatoes at 40s. per ton will give spirit at a cost of 10½d. per gallon for the potatoes alone, and you would have to add to that, would you not, the working cost and the cost of the agent which you would use for converting the starch into sugar ?—And the loss of the grains.

Prices of spirit. (*See also* Q. 5084–7.)

5144. (*Mr. Tyrer.*) Did you give 1s. 3d. as the present price of spirit ?—I gave 1s. 3d. as the highest price I had known in the last fifteen years for methylation.

5145. What is the lowest ?—The lowest we have sold at has been 7½d., but we were selling at a loss then; we were doing it for market purposes and not for profit.

5146. (*Mr. Nicholson.*) Of course you would be glad to see an increased use of alcohol industrially ?—Yes, I think it would be a good thing.

Suggested rebate on denatured alcohol.

5147. Could you suggest any way by which the use of methylated spirit or partially denatured spirit might be increased, beyond your suggestion that the amount of methylic alcohol added might be reduced ?—Yes, I think I could make a suggestion. First of all, talking of spirits for industrial purposes, I want to separate out rather the spirits used simply as pure spirit and the spirits used after they have been denatured. Of course, it must be in the interests of the Excise to encourage the use of denatured spirits as far as possible, because directly the spirit is denatured they have no more responsibility, as that spirit can go anywhere in the country without risk of its being used for improper purposes. I should suggest that the methylator should be given a rebate on the spirits used for methylation of 5d. in the case of foreign spirit, and of the same amount in the case of the home-made article. At the present moment the foreigner pays the 5d. and the home distiller has more than five-pennyworth of restrictions.

5148. You would suggest that that should apply to everything, would you—to motor purposes, for instance? —Yes, in all cases where methylated spirit could be used.

5149. (*Mr. Tyrer.*) Do you mean the old form of methylated spirit or methylated spirit under the comprehensive term of "suitably denatured" ?—I think "suitably denatured," although I am strongly of opinion that for ordinary purposes naphtha is the best denaturing agent. Perhaps for chemical purposes, if the authorities consent, other denaturing agents might be used, but I do not know of any other denaturing agent which will stand the same test that naphtha will, and naphtha has stood the test for over fifty years.

5150. (*Chairman.*) You said just now that you would make an allowance of 5d., but it must not be one figure for British spirits and another figure for imported spirits—it must be the same for both—either 5d. for both or 3d. for both ?—Yes, precisely.

Mr. R. F. Nicholson.

1 Feb. 1905.

5151. (*Mr. Nicholson.*) There is one question I omitted to ask you *à propos* of the use of molasses. Taking the total quantity of spirit used industrially, can you give the Committee any idea of the proportions of molasses and corn from which that industrial spirit is made?—Yes. On looking at the Excise returns I see that last year over 41,000 tons of molasses were used for distilling. That would not produce more than 75 per cent. of the total amount of spirit sent to the methylators, and the other 25 per cent. must therefore be made from corn. On the other hand, we know that a certain amount of the spirit produced from molasses was used for other purposes—for instance, for duty-free alcohol for chemists, and in some cases for export.

Relative quantity of molasses and corn used for industrial alcohol. (*See* also Q. 5136–8).

5152. (*Mr. Tyrer.*) Under drawback?—Yes. Therefore the proportion of grain spirit which was used for methylation last year must be over 25 per cent of the total quantity.

(*See* Q. 5145)

5153. As to the price of the average spirit, I understand you to say that the low price you have mentioned, 7¼d., was really a competitive price?—It was a fighting price. It was an absolute loss.

Conditions of production of spirit (Revenue and otherwise) in England and Germany discussed.

5154. One of the impressions that has been on my mind and on that of every outsider is that spirit in Germany at its prime cost was very much cheaper than in England, and Mr. Nicholson has often asked this question of witnesses: Are you aware that practically they are State-aided by a direct concession for industrial purposes, which makes a vast difference? One may say that it is a desirable thing to have that point perfectly clearly set out in the evidence we have had here, and therefore it is that I asked you about your lowest figure. Do you know what is the very lowest figure at which German spirit has been put upon the market in Germany for industrial purposes?—No, but I know that German spirit has been sold in London at 4d., delivered carriage-paid and casks found, and that does not give more than 2d. to the manufacturer. But that was nothing more nor less than a case of dumping; in fact, they might have paid for people to take it; it was not the market rate.

5155. How many years ago was that?—Three to four years ago.

5156. Before the Centrale began its curtailing arrangements?—While the Centrale were at work, but when they were trying to capture the methylating market in England.

5157. It was a pure case of dumping then?—Absolutely so.

5158. What relation had that apparently ridiculous price of 4d. to the actual cost of production?—I cannot tell you exactly what their bounties on export came to, or what the bounties on their mode of manufacture amount to, but we as distillers understand that their home cost is several pence above our home cost in England.

5159. That is to say, the cost, so to speak, to the warehouse door?—Yes; that is several pence above the cost in England, and England is the cheaper market of the two.

5160. In other words, the production from the rather limited variety that you have here of amylaceous materials gives you an immense advantage in production over the almost sole production from potatoes and beets in Germany?—I do not quite follow you there.

5161. With equal conditions we can produce from the grain under normal conditions as cheaply as Germany can from their materials under normal conditions?—Certainly.

5162. (*Mr. Nicholson.*) Excise restrictions, that is apart?—Yes. With material, plant, machinery, and so on, on equal terms, we can produce cheaper than they can.

5163. (*Mr. Tyrer.*) That statement is the foundation of the whole superstructure. If we can produce spirit here on equal terms with the Germans, then comes the question of Revenue and various other questions which differentiate us from them?—Yes.

5164. (*Dr. Thorpe.*) On *a priori* grounds, assuming that our plant is as effective and our workmen are as skilful, do you know any economic reason why we should not produce as cheap as anybody?—I think what Mr. Tyrer means is, are the materials we are using as cheap as the materials that the Germans use?

5165. (*Mr. Tyrer.*) Not quite; mine was a wider question. That is included in the question, which was, whether on equal conditions all round we can produce as cheaply as in Germany. Suppose our restrictions and so on are much more severe than they are in Germany—that is the popular opinion, but I do not say whether they are so or not—then if we are on equal terms as to conditions (which includes materials, the source of supply and the cheapness of the materials)—taking it that they use 75 per cent. of potatoes, a small quantity of beet, a small quantity of molasses, and a larger proportion, but by no means preponderating or overwhelming quantity of grain—taking all that, in your opinion can we produce spirit as cheaply as they can—I am leaving out of count Government rebates or anything of that kind?—I do not quite follow.

5166. (*Chairman.*) Have you any knowledge of industrial distilleries in Germany?—No, I have not.

5167. (*Mr. Nicholson.*) In regard to concentration, have they greater freedom in German distilleries subject to certain chemical and physical conditions than we have as regards the strength of worts and so on?—Their conditions are very much freer in working.

5168. (*Mr. Tyrer.*) Would it be possible with the existing plant for British distillers to work with conditions more nearly like those in Germany as regards the wort?—I think the conditions brought about in Germany are brought about by their Revenue allowances, and so the Germans work in a way that would give them the largest margin on those allowances. For instance, they use a thick mash, so that they get a larger margin in their gauges and strength.

5169. Is there any reason why you should not adopt a similar plan with your existing plant?—We have not got the object they have of working in that way. They get a larger bounty by so doing, if I may put it in that form.

5170. Would you be able to turn out more, supposing the demand arose?—It is rather according to the way they are gauged.

5171. The Revenue conditions in their way give conditions which appear to be so different to ours because of the Revenue considerations, whereas ours appear to be lessened so far as production is concerned in consequence of similar restrictions on the part of the Revenue; is that practically what it comes to—in other words, does the Revenue prescribe what you shall do here?—Rather the Revenue in Germany makes it advantageous to the trade to work in an extreme fashion so as to get the bigger allowance.

5172. What would be the objection, assuming such a thing?—We have not got the incentive here. Whichever way we worked we should not be more duty free. We should have to pay the same duty whichever process we adopted. I may give you a case in England which would be easy to explain. In taking the charge of spirits in a receiver, the charge is taken with a dipping rod marked in inches and tenths of inches by the Excise. The law prescribes that no trader shall have a spirit receiver less than 15 inches in depth, with the object of preventing excessive diameters, which would mean a large margin between real and indicated content, as each tenth on the rod represents gallons varying according to the diameter. So it is rather with the German restrictions; the restrictions are framed first, and then the German distiller works as closely as possible to those restrictions and gets as much advantage as he can out of those restrictions.

5173. Did I hear you aright when you said that the plant of an English distillery was many times larger than was required?—Yes.

5174. It rather alarmed me to hear that you put down so much plant—many times larger than was required?—That is so, and I say that I saw a distillery turning out more than three times what we are doing at Bromley, and it was a very small distillery indeed.

5175. Was the supervision, so far as you could see, so slight as to cause you to envy their system as compared with ours?—I should not think it was very efficacious. At that time in America their duty was not nearly so high as ours in England.

5176. It was some few years ago then?—It was ten years ago.

5177. Have they got much more strict since then?—Yes.

5178. (*Dr. Thorpe.*) In the American distillery I suppose they are working day and night all the week?—Day and night always—absolutely continuously.

5179. (*Mr. Tyrer.*) Of course, they have no methylation there?—That is so.

5180. And they have no rebates on exportation?—No.

Beet as a source of spirit. Experiments unsuccessful.

5181. Just one point about other materials; while potatoes have been possibly ruled out of consideration because of price per active material, what is the objection to beet?—Some years ago, prior to 1870, there were, according to the Excise report, no less than twelve distilleries working on beet experimentally, and every one of them came to grief.

5182. Was that due to their methods, or was the experiment so expensive that the funds were exhausted before it was properly carried out?—I should think it was due to the methods, but I cannot say that. However, I know that in one case there was plenty of capital.

5183. (*Mr. Nicholson.*) And the experiment was on a very large scale I believe, some 700 acres being cultivated with beet?—It was on a very large scale.

5184. (*Mr. Tyrer.*) There might be two forms of inefficiency, one, not understanding the conditions of fermentation and so on, and some conditions of that kind; but chiefly the condition under which the cultivation could be most efficiently conducted. Assuming that past experience was utilised, would there be more hope of the utilisation of beet to-day than of potatoes?—Speaking as a farmer, I should say that there would not be much hope in either case.

The Surtax. Increase from 4d. to 5d. in 1902. (*See* Appendix No. I, p. 229.)

5185. Then there is another point which is of very considerable importance, and that is the amount of the compensation—the surtax. When I had the pleasure of seeing you first, it was, I think, 4d.—the extra penny making 5d., I suppose, would be admitted to be an artificial condition of things, the penny being put on when the Corn Tax was put on, but not taken off when the Corn Tax was repealed?—It was put on under rather peculiar circumstances.

Excise restrictions on production of spirit. (*See ante* Q. 5096-7.) Strict supervision is to the interest of distillers.

5186. Supposing you were allowed in any extended degree to produce from materials which you could use in the production of alcohol on commercial principles, that is to say, materials from which alcohol could be cheaply produced; do you think there could be modifications of the internal arrangements and supervision as between the place from which things come and the place to which things go, which would facilitate the cheapening of production? As I understand it, it is the supervision which most intimately touches the operations at every stage; do you think, consistently with the interests of the Revenue, we could have a less minute supervision, and therefore a less costly supervision within the distillery?—I think the supervision is drawn up with the object of suiting all kinds of distilleries—including small ones turning out perhaps not more than 20,000 gallons a year or even less; and that unless the manufacture was watched carefully from beginning to end there would be a danger of great loss to the Revenue in small places. Of course, the bigger the distillery the more continuous the work and the easier the survey; but except in a few cases, and those only in small points and of small value, I do not think that any important modification of the restrictions could be brought about, at any rate not wisely.

5187. In other words, you think the present restrictions are as much for your safety as that of the Revenue—that is another way of putting it?—I think that as lawful traders we distinctly look to the Excise to protect us against unprincipled manufacturers.

5188. Therefore, the supervision should be minute and equal?—Yes, we want to be very strict and very definite, but we think in certain cases the incidence of the supervision might be a little easier.

5189. One, of course, thinks very much and seriously of the conditions in America, but they would appear from your observation to be as much easier at the one end of concession as ours appear to be minute at the other end of regulation?—Yes.

5190. And yet so far as my reading of their regulations goes (and I have been through one of the American distilleries) it confirms what Dr. Thorpe has told us, that every nation has asked for our particulars, and that their regulations are remarkably similar to ours?—Many of them are the same. For instance, I noticed that the rectifying premises had to be separated from the distillery premises, the law in England being at a quarter of a mile; the Americans made it one-eighth. I went to one distillery where there was not a building for miles and miles around, and these two buildings were standing in the middle of a prairie, with a little railway track between them.

5191. I think I understood you to say that you were not methylators?—No, we are not.

Spirit for methylation. Increasing demand for a better quality.

5192. In that connection I think I also understood you to say that the quality of spirit produced for methylating was special; that is to say, it was not as pure and as highly rectified as that for plain spirit?—As you know, methylated spirits are used for many purposes, and some of it for very common purposes indeed—burning and so on; but there is distinctly a tendency now for a demand for better and purer spirits for methylation. I suppose it is probably when it is going to be used for chemical purposes or for photography or something else like that; in fact, we have a demand regularly now for one quality which is called "Water-white," absolutely colourless and as pure as we can make it.

5193. For methylation?—It goes to the methylators for methylation. We have always a chance of foreign spirit coming in highly rectified for methylation and being taken in preference to any that we might produce, because prices being equal, of course the trader will take the very finest article that he can procure. So if there is an extended use of spirit for methylation for industrial purposes, undoubtedly we shall have a marked increase in the demand for the better quality spirit.

5194. In other words, you will be screwed up to the average level of imported spirit from abroad?—Screwed up to the best quality we can produce.

Foreign competition.

5195. But that involves a statement I was rather sorry to hear; namely, that when a comparison has been instituted yours has not been so white as the foreign imported spirit?—I did not say so. I said that was a danger we had, that the foreigners might send in highly rectified spirit to compete with our less rectified spirit; in fact, for a year we were supplying our customers with foreign spirit because we could not buy molasses at the time. Before the year was out we had incessant letters from all our customers, hoping that the contract would soon come to an end, because the quality was so very inferior, and all asking for the English spirit. As you know, to-day it is all English spirit.

Cost of methylated spirit not appreciably reduced if methylated at distillery.

5196. I personally can say that in the last few years the quality of the spirit has been very much improved. There is an advantage in the question of the cost, too, to those distillers who are also methylators, is there not, if they methylate without having transit, freightage, and cartage to the methylators' premises?—Yes, but there are very few distillers who are methylators: I do not think there are more than four, if as many.

5197. When Mr. Nicholson was speaking, it occurred to me that if spirit is taken to a rectifier's place away from the distillery, then to the extent of the cost of the removal of that spirit, the spirit for technical purposes direct from the distillery could be slightly cheaper?—Yes.

5198. (*Chairman.*) That is to say, if you save the intermediate step of its going to a methylator, and if it went direct from the distillery to the consumer, it would make a little difference?—Yes, but it would make very little actually, because we are dealing with strong spirits, so the bulk is small, and I think in most cases the methylators are very near the distillers. There is no law keeping them at arm's distance, and they can be exactly outside. In many instances that is the case.

Mr. R. F. Nicholson.

1 Feb. 1905.

A demand for alcohol of high strength could be met without difficulty.

5199. (*Mr. Tyrer.*) One question to remove, not a wrong impression on my mind, but a wrong impression on some minds: The distiller can produce, can he not, a very high strength spirit with his existing apparatus, say from 95, 96, and even 97 per cent. ?—Certainly.

5200. There would be no difficulty in doing that ?—There is no difficulty in the way of strength.

5201. Assuming there was a demand, as there might be, would there be any difficulty in your making 99 or 100 per cent. alcohol ?—I have inquired into that matter, and I have found that a short time ago there was one firm of chemists who were making absolute alcohol, but the amount actually in demand was so small that they gave up the process; in fact, they offered their plant to us, they said, for a song. So commercially, although you might be able to sell a few hundred gallons of absolute alcohol in a year, I think that would be the outside of your output.

Use of tank wagons for carriage of spirit. (*See* Q. 4953-6.) An advantage to users of industrial spirit rather than to distillers and rectifiers.

5202. (*Chairman.*) We have had it suggested by a witness before us, who is a very large user of industrial alcohol, that it would be a great advantage to allow spirits to be moved about as they are moved in Germany, in large tanks instead of in puncheons; from a distiller's point of view, would there be any advantage in that ?—Do you mean denatured alcohol ?

5203. Either denatured or not, as the case may be. At present it must go in casks, I think ?—Either in casks or in drums.

5204. We saw in Germany huge tanks that go on a railway truck, containing very large quantities ?—I know them well.

5205. Do you see any disadvantage in those ?—As far as denatured spirits are concerned, I see no disadvantage whatever. As regards spirits under bond or for duty, I do not see how you can accurately gauge the content each time, and it would be giving up the Excise strict and exact system of indication by weight.

5206. Still, the tank is impermeable; it is made of metal, is has only one bung, and if that is secured by a seal which it unbroken when it arrives, would you not have practical security that there had been no tampering with it ?—I think for duty-paid alcohol or under bond no one would have the need for taking spirits about in such quantities. The large buyers would be rectifiers, and I do not think they would ask for them; in fact, as rectifiers ourselves we should not use them.

5207. In this particular case the idea was that the quantity required at one time is roughly about 2,000 gallons; therefore it was suggested that if you could get your 2,000 gallons in a single tank of this kind instead of putting it into 20 puncheons of 100 gallons each, there would be a great economy in handling, and so far as the Revenue was concerned it would be just as safe, because the tank could be gauged, closed, and sealed, and could be gauged again on its arrival ?—Do you mean in sending spirits to a methylator ?

5208. Or to a factory in which it was to be used after being specially denatured, which can be done now under the recent legislation ?—It might be useful for that, but not for duty-paid alcohol, certainly.

5209. You do not think for the distillers and rectifiers—the trade itself—that that particular method would have any great advantages ?—No; in fact, it would have one disadvantage that I can see at once.

5210. What is that ?—That there would be only one gauge, so there would be less tenths allowed, and so on.

5211. (*Dr. Thorpe.*) In Germany the thing is controlled really, and they do much more frequently weigh the spirit and take its strength. Practically they do not measure it at all. They do not use the same kind of system that we do; they actually weigh the spirit and determine the strength and they get the real content of alcohol in that way. I presume that by such an arrangement as that the actual alcoholic content would be more accurately ascertained than we can ascertain it by measuring ?—Weighing is the law in all British distilleries.

5212. (*Mr. Nicholson.*) Anything which tends to decrease the price of spirit for industrial use is to be welcomed from the distillers' point of view ?—Very much so. It would certainly save both work and expense in sending large quantities of spirit to the methylator, and it might save time.

Bonding of industrial spirit not usual.

5213. (*Chairman.*) Taking our last report, I see that on the 31st March, 1904, there were altogether in bonded warehouses no less than 167 million proof gallons of spirit. I suppose of that not a very large part would be the kind of spirit that we have been talking about; namely, the spirit that is used for industrial purposes, and that it would be mainly whiskies ?—It would be so entirely.

5214. Then this particular industrial spirit does not remain in bond ?—No, a distiller would work with as little stock as possible, because owing to its high strength there is a large evaporation.

5215. And it does not improve in any sort of way ?—No.

5216. (*Dr. Thorpe.*) There is no question of maturing in that case ?—No.

Output of industrial spirit could be increased without difficulty.

5217. (*Chairman.*) Then turning to the figures of methylation during the last four or five years, I see the quantity of spirit methylated has been just a little over 5,000,000 proof gallons. Supposing there was an immensely increased demand for spirit for methylation for industrial purposes, and those quantities were doubled—which is a pretty liberal allowance—I suppose there would be no sort of difficulty in meeting that demand. I mean the existing sources of supply in the distilleries, your own and others, would meet it, and it would be a mere fleabite to them ?—It would be very easily met—in fact, it would be less than the variation in the make of one year and another.

5218. It would be about an addition of 10 per cent. to our total annual production of all spirits, which is about fifty million gallons—sometimes more ?—Yes, it was fifty-one millions last year.

Mr. ARCHIBALD WALKER, called; and Examined.

Mr. A. Walker.

5219. (*Chairman.*) You are a member of the firm of Archibald Walker & Co., distillers, of Liverpool and Limerick ?—Yes.

5220. And you are Director of the Distillers Company, Limited, and of the Vauxhall Methylating Company ?—Yes.

5221. Are your distilleries in Liverpool and in Limerick ?—Yes.

5222. Have you any distilleries in Scotland ?—The Distillers Company, Limited, have a number of distilleries in Scotland.

5223. In Edinburgh ?—They have a large number of distilleries in different places. They have the majority of the grain distilleries in Scotland.

5224. Is the Vauxhall Methylating Company a branch company ?—That is my own business.

5225. Is it affiliated in any sort of way with these others ?—I have the same partners.

5226. But still it is a separate business ?—It is a separate business, in a way.

Cost of methylation varies with price of wood naptha, which is now, cheaper than formerly.

5227. In the Vauxhall Methylating Company what sort of quantity do you methylate a year; is it a very large amount ?—Yes, we are fairly large methylators.

5228. And, of course, you draw your supplies of spirit from the companies in which you are interested ?—Yes, from Liverpool.

5229. From your experience at the Vauxhall Methylating Company, what is your estimate of the cost of methylating ?—It varies very largely with the cost of the naphtha, with the handling and the freight on it.

5230. Wood naphtha is a good deal cheaper now than it was some years ago, is it not ?—Yes, it is very much cheaper.

5231. One witness that we had before us, who was himself a methylator, gave us an estimate of 2d. per gallon as the cost of methylating, but it was not per-

fectly clear to the Committee, I think, whether he was referring to the extra cost of the materials, or to the cost of the materials plus handling ?—The cost of the material would have to go on to that, because it is only recently that the naphtha has come down so much.

5232. The present price of the naphtha that you use for methylating is under 3s., is it not ?—It is under 3s. now.

5233. Going back ten years, what were you paying then, do you suppose ?—I asked the manager of the methylating business, and he told me that 5s. was a fairly usual price in past years. But that is not from my own experience—that is what he told me.

5234. You are interested in this question both as a producer of spirits and as a methylator ?—Yes.

5235. And from both those points of view you would be glad to see an extension in the demand for spirit and for methylated spirits ?—Yes.

5236. Supposing there became a very extended use of spirit specially denatured at the works, might that affect your methylating business ? At the Vauxhall Works is it mainly what we call mineralised methylated spirit that you make, or do you also produce the methylated spirit with only 10 per cent. of wood naphtha added ?—We produce both kinds.

Effect of a reduction in proportion of wood naptha used for methylation, on the security of the Revenue,

5237. The second kind, namely, the kind that has only 10 per cent. of wood naphtha in, is only used under a license and by authorised persons for authorised purposes ; is that not so ?—Yes.

5238. If the quantity of wood naphtha were reduced from 10 per cent. to 5 per cent., what is your opinion as to the effect that would have upon the security of the spirit ?—That is really a question for Dr. Thorpe.

5239. I know it is, but I wanted to know your opinion ? —I am a chemist, but I would not put my opinion against his.

5240. You are handling this from day to day ?—I am not.

5241. Not you personally, but in your business ; I wanted to know whether you had formed any opinion whether the 10 per cent. was an excessive dose of wood naphtha, or whether a dose of 5 per cent. of wood naphtha might be sufficient ?—The prevailing idea is that a less dose would do.

5242. That is the prevailing idea you say ?—Yes, I think so ; but then I could hardly put that forward as my opinion.

5243. But I would like to know it if you think so ?—I think that the prevailing opinion is that a less quantity of wood naphtha would do, and that other substances might possibly do.

5244. (*Dr. Thorpe.*) In addition or in substitution ?—Both—either in addition or in substitution.

5245. (*Chairman.*) If you were responsible would you regard 5 per cent. of wood naphtha and nothing else as a pretty good protection for spirit, provided it is not sold in every shop, and provided it is used only in the way that what we call the ordinary methylated spirit is used by authorised persons for specified purposes ?—I should think so, but really I have no special information or experience about that.

And on price of methylated spirit.

5246. Would that have much effect in cheapening it ? Would you be able to sell that spirit 1d. per gallon cheaper? —It depends upon the price of the naphtha, really. If the price of the naphtha were dear it would certainly make a considerable difference. It would make a difference now.

Methylation in separate casks not a material advantage.

5247. And now as regards the process of denaturing. Would it shorten the process, or cheapen the process, if, instead of doing as we do now, having all the casks emptied out into a tank and the mixture made in that tank, you denatured each puncheon as it came in ? How would that affect your business ? I ask, because we have just been over to Germany and we have seen it done there, where of course they denature at least ten times the quantity that we do. They denature, not always, but in many cases, each separate puncheon ; they take the content, and then of course there is a vacuity left, and they put in just the amount that is required to denature. They roll the cask about, and it goes out again in a denatured condition. Do you think that would be a better way ?—It might be a convenience in some cases.

5248. Would it ?—It might be, I could not say.

5249. Would it be any material advantage ?—I do not think so.

Output of industrial spirit could be increased without difficulty.

5250. Have you any difficulty in these companies that you are interested in, in getting rid of the silent spirit that you manufacture ?—We are restricted in producing.

5251. I suppose that is of late years ?—Yes.

5252. Since the Pattison case ?—Yes.

5253. Is that beginning to put things on a better footing ?—I think it is now.

5254. There is no great surplus at the present moment in the country of this spirit that is used for industrial purposes, is there ?—No.

5255. But the output could be very largely increased without any difficulty ?—Yes.

5256. And without materially adding to the cost or the selling price ; I mean supposing the demand were doubled, do you suppose the price would go up much ?—I do not think so. The price of the spirit depends largely upon the price of the raw material.

Materials used for industrial spirit.

5257. In manufacturing for industrial purposes and methylating purposes what material do you use ? Is it mainly molasses ?—We use both molasses and grain.

5258. I suppose there are times when maize is very cheap, are there not ?—Yes.

5259. Have you used maize ?—Yes.

5260. But in the last year or two it has been dear ?—Yes, but it has been used all the same.

Cost to distillers of Excise restrictions. (*See* Q. 5091–5116).

5261. You heard what Mr. Nicholson said as regards the effect of the Excise restrictions upon the cost of manufacture and so on ; do you agree generally with his remarks ?—Yes, generally.

5262. Would you agree, for instance, that it is not going too far to say that the Excise restrictions increase the cost of manufacture by at least 50 per cent., that is to say, if a spirit cost 9d. to produce, one-third of that is due to the Excise restrictions, so that that spirit without the Excise restrictions could have been produced at 6d. That means, therefore, that we have increased its cost by 50 per cent. would you say that that was a fair estimate ?—It is difficult to say exactly. It might be more in some cases ; I am quite sure it would be a great deal more in certain cases.

5263. In the establishments that you are interested in, do you consider that the capital invested in buildings and plant has been considerably increased by the Excise restrictions ?—Enormously.

5264. I suppose that the cost of working is greatly increased by the separation of brewing and distilling ?—Yes.

5265. Speaking generally, I take it you are very much in favour of removing any unnecessary restrictions upon the use of spirit for manufacturing purposes ?—Yes.

5266. The more spirit that is wanted the better it would suit the distillers ?—Yes, I think so.

Restrictions on sale and distribution of methylated spirit. Question how far they are the cause of high retail prices.

5267. (*Mr. Nicholson.*) You have rather made a study, I think, of the question of the sale and distribution of methylated spirits in the country, have you not ?—I have got some prices of methylated spirits here. I think the difference between the wholesale price and the retail price is high compared with what it is in Germany, and I think that that is largely due to the number of small restrictions that are made on the sale of methylated spirits in small quantities.

5268. (*Chairman.*) It would be interesting to have your figures ?—It is just a number of prices that I have ; they run to about 5d. per pint.

5269. (*Mr. Nicholson.*) That is sold retail ?—Yes.

5270. (*Chairman.*) Then you are dealing with the mineralised methylated spirit that could be brought in any grocer's shop ?—Yes, sometimes it is up as high as 1s. per pint.

Mr. A Walker.

1 Feb. 1905

5271. (*Mr. Nicholson.*) That would be partly because the retailer will not be bothered to take out a licence or will not be bothered by the forms ?—Yes.

5272. (*Chairman.*) What would be the price at the present moment in a retail shop ? Would it be be 2s. 6d. per gallon ?—I have a number of cases, 3s. 3d., 2s. 3d., 3s. and 2s. 6d. per gallon. The prices per pint are dearer, of course.

5273. That is a pretty wide range ?—Yes, it is.

5274. (*Dr. Thorpe.*) How have the Excise restrictions brought that about ?—A man has to pay for a licence and there are a number of restrictions put on him in the way of request notes and details which do not really amount, I think, to much, but which are for the security of the Revenue. They perhaps prevent more than one man in a village or more than one man in a town taking the licence out.

5275. Therefore in consequence of that the man himself is in a position to demand a larger profit, is he not ?—Yes, and that curtails the supply.

5276. In a case near here, for example, where competition is pretty rife and almost every oil and colourman I suppose supplies it, do you not also find the same wide variation in the prices ?—There are pretty wide variations in the prices even in places like Liverpool ; but the retail and wholesale prices do not come nearly so close as they do in Germany, where they are given as very near ? That is largely due to the action of the Syndicate in Germany.

5277. But I cannot yet bring myself to believe that this artificial enhancement of a price which is so extraordinary here is entirely due to the Excise restrictions. I think it is due to the absence of any standard of value such as practically is laid down in Germany ; people in Germany are taught to know what alcohol ought to be sold at ?—Quite true.

5278. Just as they are taught here in this country what beer ought to be sold at ; everybody knows exactly what a pint of beer costs here, and nobody can enhance the price of it ?—It is used so much more largely there ; that is the real reason.

5279. It is not therefore because of the Excise restrictions ?—They have a good deal to do with it, I think.

5280. Take the Army and Navy Stores and the Civil Service Stores ; whatever the effect of the Excise restrictions is, it is to be felt in the operations of those trading concerns ?—Yes.

5281. Therefore you may say you get the proper value plus the Excise restrictions upon retailed methylated spirit ; nevertheless if I move 200 or 300 yards from either of those centres of trading I can find traders who charge absurd prices for methylated spirit ; and that, I venture to say, is not in consequence of the Excise restrictions but is really in consequence of the public sentiment not attaching any particular standard of value to the article that they are buying ?—The Central Agency or Syndicate in Germany have done a great deal in educating the German public up to that and in seeing that they get supplied at a very small profit to the dealer. They practically insist on that. It is quite open to the distillers in this country to do that too.

5282. May I remind you though that there are still Excise restrictions in Germany, and that all these retailers are under some kind of restriction, so that the restrictions, such as they are, are reflected in the price at which the spirit is vended per litre, whatever it may be ?—Yes.

Conditions of production of spirit in Germany. Government bounty.

5283. (*Mr. Nicholson.*) You have also, I think, made a considerable study of the German conditions, have you not ?—Yes. I have prepared a statement which, I think, will explain how the German prices are so much cheaper than our own.

5284. (*Chairman.*) Perhaps you would not mind handing that in, because, after all, it would be only, as it were, second-hand evidence, and we have ourselves just been over in Germany rather with a view of getting it at first hand ; but it would be very interesting to have this handed in as a statement which we could criticise ?—I shall be happy to do that. (*See* statement on page 203).

5285. I fancy you have reduced the advantage which the German distiller gets to terms of 1s. per ton of potatoes, have you not ?—Yes. Taking a fairly large distiller in Germany, making 63,000 proof gallons a year, and with an allotted quantity of 27,900 proof gallons—you see he is working largely over his allotted quantity—supposing he exports it, or gets it methylated, the bounty he would receive would amount to 18s. 3d. per ton of potatoes used. If he were working inside his allotted quantity the bounty would amount to about 31s. 6d. per ton. That means in the one case a bounty of about 4¾d. per proof gallon, and in the other case of about 8½d. per proof gallon. These are taken from the *Zeitschrift fiir Spiritus Industrie.*

5286. (*Mr. Nicholson.*) You are not now referring to this paper which you have just handed in, are you ?—No, but that explains how it is done. I have taken the figures from this German paper, where they were discussing a typical distillery.

5287. The price of potatoes used in the distilleries in Germany is purely an artificial one ?—Yes.

5288. This statement that you have now made explains that to a large extent, by pointing out that the bounty that they receive on their spirit amounts to at least 18s. per ton in addition ?—In this particular case it amounts to 18s. per ton.

5289. And that case you take as a fairly typical one ?—It is given in the paper as a sort of typical one.

5290. (*Mr. Tyrer.*) With a possible bounty of 31s. 6d. per ton ?—Yes, or more if the distiller had been a small one and making only within the allotted quantity. I think it important to note those figures, because people are saying that German alcohol is so cheap because the British distiller is behindhand in his methods ; but no amount of distilling skill can compete with a bounty like that.

5291. Are you aware whether it is the fact or not that at the present moment restrictions are becoming more onerous in Germany, and that the official mind there is being directed to their rather liberal concessions—to their excessive liberality, if we may put it in that way ?—I think it is high time.

5292. Do you know that it is so ?—No, I did not know that, but I am glad to hear it.

5293. The restrictions here were in your mind, were they not, when you were speaking of the retailer, and the cost of the licence, and so forth ; but do you think it would be possible to reduce the cost of the restrictions upon that portion of spirit manufactured for industrial purposes as distinct from that prepared for potable purposes ?—To split a distillery in two, or to allocate certain distilleries to make one sort or the other, do you mean ?

Allowance on spirit for industrial purposes recommended

5294. It might be either way. Take your own case ; might not the amount of spirit which was allocated to industrial use be treated preferentially as regards the allowance or surtax ?—If you mean by receiving a drawback, it might be done that way.

5295. Would that help very considerably ?—I think a drawback should be allowed on the spirit used for industrial purposes.

5296. Would there be any difficulty, so far as your experience of the revenue procedure is concerned, in allowing a drawback on spirit used for industrial purposes ?—No.

5297. Of course it would be necessary that the portion which is to have duty paid ultimately upon it at some point or other in its history should be carefully looked after, and that without prejudice to that portion which is intended for industrial purposes and is to be relieved from some of the cost of the restrictions ?—I do not see how it can be done, except by giving a drawback on the spirit used industrially. I think that is a fair way to do it. It is rather hard to tax the chemical manufacturer because the Government wish to raise a large quantity of duty from the alcohol that goes into consumption.

5298. I do not say that there would be any difficulty myself, but supposing the Board of Inland Revenue were to make some such proposal, would there be any objection on the part of the distiller to so denaturing industrial alcohol that it would be practically impotable during the course of transit to its destination ?—That is practically what is done just now.

5299. That is, where a distillery is also a methylating place it is done ?—Yes, it is. It goes under bond or under Excise supervision all the way.

Excise supervision must be the same for production of industrial and potable spirit.

5300. (*Mr. Nicholson.*) I do not quite clearly understand your answers to Mr. Tyrer. You are not of opinion that spirits should be made under different sets of regulations, are you ?—No, but that after the spirit is made it should receive a drawback.

5301. Then all spirit should be made under the same regulations ?—Yes.

5302. (*Mr. Tyrer.*) I was not considering that point, but I can see the difficulty at once. I never supposed that you would have a distillery cut in half and, so to say, divided into two distilleries ?—No, you could not.

5303. (*Mr. Nicholson.*) Nor could you have even two distilleries, one for one purpose and one for the other ?—No.

5304. (*Mr. Tyrer.*) Whatever the supervision, whether it is smaller than now or greater, it must be the same for both spirits within the distillery; it would simply be a question of allocation. You do not think there would be any serious detriment to the Revenue, if there was a rebate on the alcohol intended for industrial purposes ?—No, I do not. Practically there is a rebate for export; and the same principle should apply to alcohol used industrially.

5305. In other words, putting the two more nearly on a par, if not giving a preference to the industrial uses rather than to export ?—Yes.

Materials for distillation.

5306. As to material, do you think that the usual range which the British distillers have is simply governed by question of supply and demand and the ordinary rules of the market, and that there are no artificial restrictions in the way of duty ?—Yes.

5307. After that it adjusts itself and comes down to buying the most suitable materials at the price ?—I think so.

5308. Therefore, in that respect, there is no need for a change ?—In regard to the materials, no.

5309. And you would deprecate taxing materials which are intended for an industrial purpose of that kind, because it would make them dearer, of course ?—Yes.

Potatoes and beet. (*See also* Q. 5139-43 and 5181-4)

5310. Do you hold the same views as Mr. Nicholson in regard to potatoes and beet ?—I think so. I have never worked potatoes, but I think in this country, at any rate, that they are not at all suitable.

5311. Would you say the same thing with regard to beet ?—Beet, I think, was largely used in Germany at one time, but it has gone out. I think the natural outlet for beet is for sugar.

Tank Wagons. (*See* Q. 4953-6 and 5202-12.)

5312. You are quite agreed that the facilities for handling the spirit should be in the direction of some of the evidence we have had ?—Yes; I think the more facilities that are given the better, as long as they can be given with due regard to the protection of the Revenue.

5313. So that a tank waggon of sufficient strength under Excise lock, with the regulation seal, would be, in your opinion, quite a convenient method of carriage ?—Yes, assuming it to be such as would meet the views of the Excise.

Government definition of character of Wood Naptha for methylation. Effect on price of methylated spirit.

5314. (*Dr. Thorpe.*) You are aware, of course, that within the last few years we have rather more clearly defined the nature of the wood naphtha that we require for methylating purposes ?—Yes.

5315. Has that in any way, in your opinion, enhanced the price of methylating ?—Do you mean by rejecting some of the samples ?

5316. In any way you like—has it enhanced the price of methylated spirit to the consumer ?—The price of naphtha has come down so much that I do not think it has. We are rather restricted in the market for naphtha, or rather tied down to a few sources of supply, in consequence of the Government being so particular.

5317. Do you mean in consequence of its being so specifically defined ?—Yes.

5318. Nevertheless, you tell me in the same breath that the price has come down ?—Yes.

5319. Then it has had no effect if the price of naphtha for methylating has come down ?—The price of naphtha for methylating has come down in spite of that.

5320. Then I think we may take it for granted that it has had no serious effect on the cost ?—It looks like that, I think.

5321. Are you aware generally what is the distinction between our wood naphtha and that used in France and in Germany; do you know much about the difference ?—No, I have not come in contact with it much personally.

STATEMENT HANDED IN BY MR. ARCHIBALD WALKER.

OUTLINE OF GERMAN SPIRIT TAXES AND REBATES.

Alcohol manufactured in the German Customs Union is subject to the following taxes:—

(1) *A Consumption Tax* (Verbrauchsabgabe).—A certain amount of alcohol (about 4·5 litres) per head was fixed on, and this was with certain modifications divided amongst distillers in proportion to the make for previous years. The distillers are allowed to sell the quantity assigned to them subject to a charge of 50 M per hectolitre. Anything over their fixed quantity is subject to a charge of 70 M per hectolitre.

(2) (*a*) *Tax on Wash* (Maischbottichsteuer).—Paid by agricultural distillers. This amounts to 1·31 marks for each hectolitre content of their washbacks. If the distiller gets about 8·2 per cent. alcohol from his wash this would correspond to a tax of 16 marks per hectolitre, and this is the amount of the drawback allowed on exportation, denaturation, or for manufacturers' use for this tax. As a fact the distiller gets far more alcohol from his wash than this, and the average yield in 1900–1 was 10·8 per cent., so that if the average distiller paid 1·31 M per hectolitre of washback content, he only paid 12·13 M per hectolitre of alcohol and was reimbursed 16 M on export, which shows a bonus on export of 3·87 marks per hectolitre. In the case of a great number of distillers, the tax is modified very much, and some only pay six-tenths of the tax, *i.e.* 7·27 marks showing a bounty of 8·7 marks per hectolitre, and if his yield is above the average the bounty will be still higher. The "Zeitscrift für Spiritusindustrie" the official Journal of the German Distiller's Association, describes a yield of 11·21 per cent. of spirit from the wash as a good but not brilliant yield, and taking this as a basis it corresponds to a tax of 11·68 marks per hectolitre of alcohol, and six-tenths of this is equal to 7·008 M per hectolitre paid, as against 16 M repaid on denaturation or exportation, corresponding to a bounty of about 9 M per hectolitre.

(*b*) *Tax on Materials* (Branntweinmaterialsteuer).—Paid by distillers on certain materials (such as fruit, wine, beer, etc.) and varies with the material instead of the tax on wash. This tax varies with the materials. In the case of certain distillers only four-tenths of the full tax is charged.

(*c*) *Addition to Consumption Tax* (Zuschlag zur Verbrauchsabgabe).—In all manufacturing distilleries and also in some agricultural distilleries and material distilleries instead of the wash tax or material tax, a

Mr. A. Walker.

1 Feb. 1905.

tax of 20 marks per hectolitre is charged, but this is reduced in some cases to 8 marks per hectolitre.

(3) *A Distillation Tax* (Brennsteuer).—This varies from nothing to 6·5 marks per hectolitre according to the distillery, but on export, denaturation, or manufacturers' use, the full 6 marks is allowed, and so constitutes an additional bounty.

The bounty obtainable from the tax on wash amounts to 9 M per hectolitre-	2d·7 per proof gallon
And the bounty obtainable from the distillation tax amounts to 6 M per hectolitre	1d·8 „
Or together to	4d·5 per proof gallon

In addition the fact that a distiller is allowed to make a certain amount of alcohol at 20 marks per hectolitre less than the normal duty, constitutes a further benefit; and the distiller may, if he wishes, actually receive this amount of 20 marks per hectolitre allotted quantity in the shape of Government Bills or Warrants. This is equivalent to a benefit of 6d. per proof gallon on spirit made up to the allotted quantity.

The possible benefits are:—

(1) Bounty from tax on wash	2·7 per proof gallon
(2) Bounty from Distillation Tax	1d·8 „
(3) Benefit from being allowed to make at less than the normal duty	6d·0 „
	10d·5

This is probably about the maximum that a distiller can obtain, and it is not maintained that all distillers get such large benefits; but the statements published in their own recognised journals show that the benefits they get are very considerable—in fact, without very large advantages in taxation, it is difficult to see how the small agricultural distillers could exist at all. The German Spirit Syndicate buy up nearly the whole of the alcohol made, and in order to keep up the price of alcohol for consumption as a beverage, they sell for export, denaturation, and use in arts and manufactures at prices at which they admit they make a heavy loss.

STATEMENT OF GERMAN SPIRIT DUTIES TAKEN FROM THE "KALENDER FÜR DIE LANDWIRTHSCHAFTLICHEN GEWERBE."

1902-03.

A. Receipts.	*Marks.*	£	s.	d.
I. Tax on Wash-	32,521,240	1,592,185	14	2
II. Consumption Tax at 50 M.	11,957,453	585,416	19	4¾
Consumption Tax at 70 M.	146,601,154	7,177,348	3	3½
	158,558,607	7,762,765	2	8¼
III. Addition to Consumption Tax	5,574,591	272,922	13	8¼
	164,133,198	8,035,687	16	4½
IV. Brennsteur	8,128,546	397,960	1	3½
Total Receipts I.–IV.	204,782,984	£10,025,833	11	10

1902-03.

B. Rebates.	*Marks.*	£	s.	d.
I. Refund of Tax on Wash and Material	22,179,114	1,085,852	9	1½
II. Refund of Consumption Tax	483,308	23,661	19	1
III. Warrants for Duty Allowances	36,923,610	1,807,718	8	1¼
IV. Brennsteuer Refund	4,117,705	201,595	19	5¾
Total of Repayments and Allowances I.–IV.	63,703,737	3,118,828	15	9¾
C. Alcohol from Luxemburg	15		14	8¼
A–B+C	141,079,862	£6,907,034	18	2½

These figures show that, out of a total taxation of over £10,000,000, over £3,100,000 are expended in bounties and refunding of duties.

SIXTEENTH DAY.

Wednesday, 8th February, 1905.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair*).

Professor Sir WILLIAM CROOKES, F.R.S.
Sir W. H. HOLLAND, M.P.
The Hon. J. SCOTT MONTAGU, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. W. SOMERVILLE.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*)

Mr. EDMUND WHITE, called; and Examined.

5322. (*Chairman.*) I believe you belong to the firm of Alfred White and Sons, London and West Drayton ?—I do.

5323. Are you one of the partners ?—I am.

5324. I understand that the business of the firm is that of manufacturing preparations in which alcohol is employed, such as sweet spirits of nitre, sal volatile and ethers for home consumption and for export ?—Yes.

Ether (pure) made from duty-paid spirit.

5325. Do you also manufacture medicinal or pharmaceutical preparations with spirit ?—We manufacture pure ethers, sal volatile, and sweet spirits of nitre.

5326. Do you manufacture tinctures, for instance ?—Tinctures do not affect us very much; it is chiefly sal volatile, spirits of nitre and ethers that we manufacture.

5327. (*Dr. Thorpe.*) Are we to gather that you do not manufacture tinctures ?—We do not touch tinctures.

5328. (*Chairman.*) Of those things you do manufacture the sal volatile would be a medicinal preparation, because it is for human consumption ?—Yes; it is made from duty-paid spirit.

5329. A certain amount of the ether would also be for human consumption ?—Yes, and that is made from duty-paid spirit.

5330. Is there a large quantity of spirit used for those purposes ?—For sal volatile and spirits of nitre there is a considerable quantity of pure spirit used.

Importation of pure ether at prices below that at which it can be made in this country. (*See also* Q. 5413–5).

5331. I understand that for the manufacture of those you do not desire to ask for denatured or methylated spirit; do you desire to ask for duty-free spirit ?—The only thing I want to ask about in that case is with reference to the importation of some of those things.

5332. Is there an import duty on sal volatile ?—Yes.

5333. That is incidentally, I suppose ?—Yes.

5334. Would it be treated under the head of ether ?—No.

5335. (*Dr. Thorpe.*) Perhaps you would be able to tell us whether, as a matter of fact, sal volatile is imported as such ?—I should say that it is imported, if at all, as sal volatile. The great question that I want to speak about is the importation of pure ether, which is a very serious thing at the present moment.

5336. (*Chairman.*) Is there much of that imported ?—I have heard that there has been a considerable quantity imported just lately, and that the prices are below our English prices.

5337. (*Mr. Tyrer.*) That is with the duty on ?—Yes.

5338. (*Chairman.*) The duty is £1 7s. 5d. per gallon, is it not ?—Yes. Might I give you the prices of the imported pure ether delivered free in England ? The ·720 ether is 4s. 5d. per lb. net. The ·735 ether is 4s. 3d. per lb. net. The lowest English prices for those ethers made from duty-paid spirit are, ·720 ether, 5s. 0¾d. nett and ·735 ether, 4s. 5¼d. nett. So we are quite put out of the market with regard to the prices of pure ethers. I have given you the prices delivered in London.

5339. (*Mr. Tyrer.*) Have those prices been quoted to you nett ?—Yes.

5340. That is the importer or the agent or whoever it is pays the duty ?—He pays everything, and the ether will be delivered into my warehouse if I order it. I asked for prices only last night in order to be quite sure; and a customer of mine rang me up and told me he should be bound to leave me as he could not afford to pay me more than the foreign maker. *Mr. E. White* 8 Feb. 1905.

5341. (*Dr. Thorpe.*) You charge 5s. for the ·720 ether, I think you said ?—We charge 5s. 0¾d. nett, which is practically 5s. 4d., less the 5 per cent. discount. I wish to ask for an increase of the duty on the import of ether.

Adequacy of the Import duty questioned.

5342. (*Chairman.*) Out of that 4s. 5d. per lb. can you say how much would be the duty ? I want to convert the £1 7s. 5d. per gallon into something per lb ?—A gallon weighs roughly 7¼ lbs. The British prices that I have given you are arranged prices among ether makers in England. There are not many ether makers, and that is our bottom price.

5343. (*Mr. Tyrer.*) That is to say, the ton price ?——Yes.

5344. The foreign price is in cases, just as it comes in, is it not ?—Exactly. It is a very serious matter. We shall lose our trade in pure ether if this goes on. I have got two instances, if not three, of London firms who are now at the present moment encouraging this.

5345. (*Chairman.*) I make out that on 1 lb. of ether the duty is about 3s. 9d. or a trifle over; therefore the cost price of the ·720 ether, irrespective of the duty, would be 8¼d. per lb. would it not ?—Yes.

5346. You say that for a corresponding ether you have to charge 5s. 0¾d. net instead of 4s. 5d. ?—Yes.

5347. That is nearly 8d. more than the foreign price. What quantity of alcohol do you require to make the ether ?—It depends, to a great extent, upon the gravity required.

5348. (*Dr. Thorpe.*) The ·720 ether is washed ether, is it not ?—Yes.

5349. That is, what you would call pure ether ?—Yes.

5350. To make that how much alcohol do you use ?—I should say that in a large quantity with 50 of spirit the produce would be about 30 of ether.

5351. Then the relation is as five to three ?—I should say it would be about that.* But it greatly depends upon the time of the year it is made: in the winter the production is a great deal more than in the summer.

5352. (*Mr. Tyrer.*) Do you say 50 of spirit, 64 over proof ?—Yes.

5353. (*Dr. Thorpe.*) Is this by weight ?—Yes.

5354. Then 5 lbs. of alcohol, 64 over proof, will produce 3 lbs. of practically 100 per cent. ether ?—Yes.

5355. (*Chairman.*) What would the duty be on that 5 lbs., 64 over proof ?—I do not recollect at the moment, but it is a very important thing.

* The witness subsequently wrote that on reconsideration he thought the ratio of alcohol used to ether produced was more correctly expressed as two to one than as five to three.

Mr. E. White
8 Feb. 1905.

5356. (*Mr. Tyrer.*) It should be worked out in lbs. because the result is sold in lbs. ?—Yes.

5357 (*Chairman.*) I will put the duty on the alcohol at 18s. 6d. per gallon: you have five-eighths of that which would be about 11s. 7d ?—Yes.

5358. That would make 3 lbs. of ether ?—Yes.

5359. That makes the duty 3s. 10d. per lb., does it not ?—Yes.

5360. We made out that the import duty is 3s. 9d. per lb. and as the duty on your figures only works out approximately to 3s. 10d. it looks as if, as far as the duty is concerned, its amount is enough ?—Yes. I have a letter from Mr. Howard of Messrs. Howard, complaining in the same way. He writes as follows: "We have recently heard of foreign ether (pure) coming into this market at prices which come approximately to 4s. 5d. net (·720) and 4s. 3d. (·735) and the duty has been paid." We seem all to have come across it. I daresay Mr. Tyrer may be able to say the same; I know it has affected us very much just lately.

5361. However, that is a question that stands rather by itself, namely, whether or not the present import duty on ether is an adequate equivalent for the duty upon the alcohol used in making ether in this country; and you hold that it is not ?—I think that there ought to be some further protection.

5362. (*Dr. Thorpe.*) You are in a position—nobody better—to tell us exactly what you think the equivalent duty ought to be; because of course it is largely a question of your return of ether for the amount of spirit that you use ?—I should say that it ought to be fully 3d. on the proof gallon.

5363. (*Chairman.*) If we are to admit your contention that the present import duty is too low, what would you advise that it should be instead of the £1 7s. 5d. which is about equal to 3s. 9d. per lb ? How much more would you make it; would you make it 4s. per lb ?—I cannot say at the moment.

5364. At any rate, you hold that it is considerably too low now ?—Yes. We have traced all the ether that is coming in chiefly to one place.

Ether made from methylated spirit. Suggested export allowance on spirit used in manufacture. (*See also* Q. 5416–25).

5365. What concerns the Committee more especially, is the suggestion which you make in your *precis* that ether, on exportation, should secure what you call a drawback, which is really an allowance, equal to that for methylated spirit, namely, at least 3d. per gallon on the spirit used for making the ether ?—Yes.

5366. Do you export ether from duty-paid spirit ?—Yes.

5367. Would you get any drawback on that ?—No: we do on sal volatile and spirits of nitrous ether. But that is nothing like the exportation of methylated ether for ice refrigeration and that kind of thing, and also for smokeless powder. That is the very question I was coming to; we are very much handicapped in that way. The German price is considerably under ours, and my firm has suffered very much in that way. I have had a quotation from Germany:—"In reply to your inquiry we beg to quote you for ether (sulphuric), ·730 at 49s. 9d. per cwt. f.o.b. Hamburg, nett cash, packages extra." The German quotation is much under ours.

5368. That German ether would not be made with pure spirit, would it ?—Yes, it would, so far as I know.

5369. Would it be in no way denatured ?—Not at all. I do not think they denature it for that particular purpose.

5370. The ether that is to be used in medicinal preparations must be made from pure spirit, and you must pay the duty on it ?—Yes. Supposing we had an order from a firm in India or South Africa or South America for so many gallons of ether for ice refrigeration or smokeless powder, against the German price we should lose the order.

5371. For ice refrigeration there is no necessity to make it from perfectly pure undenatured spirit, is there ?—We make it from methylated spirit.

5372. Would not the German also make it from a denatured spirit ?—He might if he liked, but I should say he would make it from the other, because it would be no advantage to him to make it in that way. Of course, he has not got the napthha in the methylated spirit like we have.

5373. Not the naphtha, but he has something else; however, that is a detail. You would make it, of course, from the methylated spirit ?—Yes.

5374. When you have made it from a methylated spirit which has paid no duty, and when you export the ether so made, what you want is that on the ether so made you should have an allowance equivalent to the allowance that a distiller would have got upon the quantity of spirit that you have used in making the ether, that is at the rate of 3d. per proof gallon ?—Yes; then we should be on the same footing as the Germans.

5375. In order to do that it would be necessary to have an accurate determination of the relation between the ether and the alcohol, so that the allowance should be calculated according to a specified rate, namely, so much ether produced from so much alcohol, and then 3d. per proof gallon on the alcohol ?—Yes.

5376. That, you think, would put you in a satisfactory position as regards competition with German manufacturers ?—I am sure that we should all make considerably more than we are making now. We are very much handicapped at the present moment, especially when the Germans are trying to fight very hard against us in this matter. It is a very hard battle for us to keep up our old customers whom we have had for very many years, and to be able to persuade them to still go on with us in preference to the German ether.

5377. (*Mr. Tyrer.*) The Chairman asked you this question: Would you be satisfied with 3d. per proof gallon, and you said you would. Has it escaped your memory that you have got your ether from the ethylic alcohol in the spirit, but that you have got 10 per cent. of commercial wood naphtha also in the spirit, the greater part of the methyl ether from which is lost, except in very cold weather or under conditions of perfect refrigeration; so that there is something to be allowed there ?—Yes, I was forgetting that.

5378. Then there is a question which we have talked about for years, and that is, as we have had evidence here, that wood naphtha itself is a costly denaturant ?—Yes.

5379. When I was talking to you and our other friends during the compilation of my papers that was a point which we discussed ?—Yes.

5380. As I understood then—and in your calculation now, you have it at the back of your mind, though probably a moment ago you overlooked it—you want to have a cheaper spirit to begin with ?—Exactly.

5381. As a matter of fact, an allowance on exportation of 3d. per proof gallon would not in itself make it absolutely profitable as against the Germans; that is, it would not enable you to compete side by side ?—It might if it were 6d. per liquid gallon; that would do it.

5382. (*Mr. Nicholson.*) Threepence per proof gallon would be equal to 5d. per liquid gallon, would it not ?—Yes; 6d. per liquid gallon would clear it altogether.

5383. (*Mr. Tyrer.*) You think it might ?—I think it would pretty well.

5384. Would you tell the Committee what the average gravity is for refrigeration ?—The chief gravity is ·720; that is what we usually send for refrigeration. ·730 is unusual for export. We are sending a quantity of ·730 ether for export at the present moment, but that is an unusual gravity, and ·720 is preferred.

5385. (*Dr. Thorpe.*) Of course, the actual allowance could be at once calculated from the gravity ?—Yes.

5386. We could always check your declaration at once by determining the gravity, and it would be easy enough to construct a scale to allow for the variation of gravity ?—Yes.

Suggested reduction of quantity of wood naphtha used for methylation. (*See also* Q. 5421–2).

5387. (*Chairman.*) Then you go on in your *précis* to suggest that for the methylated spirit which you use for the manufacture of ether a less quantity of wood naphtha might be allowed than the present 10 per cent.; that would no doubt cheapen the spirit somewhat ?—I think it would bring the price down in a very much easier way by taking off a proportion of the naphtha which has to be put into the spirit.

5388. Supposing the quantity of wood naphtha were reduced by one half, for instance, how would that compare with permission to manufacture with special denaturants such as bone oil? I dare say you are aware that in Germany for this particular kind of ether they almost invariably use a small quantity of bone oil as a denaturant?—Yes, but that is without wood naphtha.

5389. You suggest that permission might be given to suitably denature on the manufacturers' own premises; by that I suppose you mean that some special denaturant other than wood naphtha might be used,?—Exactly so.

Or special denaturing, *e.g.*, with bone oil, at the factory.

5390. Supposing the Board of Inland Revenue are willing to authorise a special denaturant, and offered to let you denature with a small percentage of bone oil, would you prefer that to 5 per cent. of wood naphtha?—As long as it does not affect the photographic people at all. I do not know that it would affect the photographic people, and as far as the smokeless powder people are concerned, or the ice refrigeration people, I do not know whether it would affect them.

5391. (*Mr. Tyrer.*) Have you ever had complaints from the refrigeration people as to the presence of oil?—No.

5392. Never?—No.

5393. You, as an engineer, and with all your vast experience in engineering on the Tyne, would know with regard to refrigeration machines whether a small proportion of bone oil would in any way affect them?—I do not see why it should at all.

5394. At any rate, it would stop for ever the drinking of the spirit or the attempt at it?—Exactly.

5395. (*Chairman.*) The bone oil would not be in the ether itself; it would be in the alcohol, and it would not go over with the ether. I meant that if you were allowed to use an alcohol which was specially denatured on the premises, and if the Board of Inland Revenue prescribed as the special method of denaturing a certain proportion of bone oil, do you think that is a suggestion which would be worth adopting in certain cases?—In some cases it would in my opinion.

5396. (*Mr. Tyrer.*) There would be no objection to it?—No. The only question is what about the photographic world?

Exportation of ether. Difficulty of distinguishing that made from duty-paid spirit and from spirit denatured with bone oil. (*See also* Q 5426-34.)

5397. (*Dr. Thorpe.*) This raises a point of great difficulty, which I think you will appreciate at once. If you take alcohol containing this proportion of bone oil which we are thinking of, namely, ·025 per cent., or four liquid ounces to the gallon of the spirit, and treat it with sulphuric acid in order to make the ether, you will find that practically all the bone oil disappears, and that you get the ether just as pure as if you had made it from pure spirit. How are you to distinguish between ether which has been made from duty paid alcohol, and ether which has been made from denatured alcohol? Is this not going to land you into trouble unless we devise some arrangement to meet it?—Possibly it might.

5398. (*Mr. Tyrer.*) You know it is a fact that no one can fail with care to distinguish between methylated ether and the other ether, unless they have gone to such a degree of purification as to make it absolutely impossible to get any trace at all?—Yes.

5399. (*Dr. Thorpe.*) As far as we have gone, experience speaks for methyl alcohol, the wood naphtha being the only diagnostic substance, the only indicative substance, we can have to distinguish between what you may call duty free ether and duty paid ether; is it not so?—Yes. There is another great thing, that with the naphtha of the methylated spirit you are likely to get the anhydrous ethers—the ·717 ether—which is a very important thing which we cannot get out of duty paid spirits at all. In the winter we cannot get it much below ·720. You cannot get ·717 ether with duty paid spirit, but you can from the methylated spirit, of course.

5400. (*Chairman.*) I rather understood for the moment that you would be almost satisfied if the export trade in ether was facilitated in respect of ether which is made from methylated spirit, and that you are not so very anxious for an export trade in pure ether?—Not so much.

German Ether. Improved quality in recent years.

5401. That would be a comparatively unimportant thing, would it?—There is not the same quantity exported of that. The great thing that I wish to speak about, of course, is the exportation of methylated ether. Some years ago they used to tell us that the great reason why they came to us for ether was because the German ether was so acid; but Mr. Tyrer, to whom I was speaking the other day about this, seemed doubtful about the matter.

5402. (*Mr. Tyrer.*) That objection held more recently than you imagine. For the last ten years certainly, I assure you, there has been nothing to say against the German ether, and no English manufacturer dare with truth depreciate the product of his rival by saying that German ether was no good, and that it was acid, and that sort of thing?—That is so now, but years ago the German ether was acid. When I was abroad in India, and those places—I was not in my father's business then—I made it a point to see if that was so, and I found that the condenser tubes of the ice refrigerating machines certainly were affected by the German ether. It was acid, and it certainly affected the tubes. Our ether was not. I made a great point to help my father in his business when I was in the engineering world, and, of course I made a point of keeping that up. But I have found in later years that that was not so. I suppose the Germans have found that out and overcome it.

Acetic Ether. Manufacture with Methylated Spirit not taken up.

5403. (*Chairman.*) You refer in your *precis* to a request which was made to you some years ago by the Government to manufacture acetic ether; at what time was that?—I should think it was from ten to eleven years ago.

5404. What happened on that occasion?—I think on that occasion we came and saw Mr. Bell here at Somerset House. We were asked to quote, and were informed that our price was entirely out of it. Then we said, could it be permitted for us to make it from methylated spirit? That was looked into. There was a set of very heavy regulations placed upon us; they wanted a special building and a special roof, and I think they wanted an Excise officer on the premises always. We do not object to an Excise officer, or any Government official, coming to our place, but we have an objection to their being there always.

5405. Is acetic ether manufactured in this country?—We make it ourselves from pure spirit, but of course there is not a very great demand for it. We make a fair quantity, but nothing like the quantity we make of methylated ether.

5406. (*Dr. Thorpe.*) Is there a very large demand for acetic ether irrespective of that which is required in medicine?—I do not know myself; we have not had any great inquiries for it.

5407. (*Mr. Tyrer.*) Were you informed that it was to be used in explosives?—Yes. At that time it was going to be a very big concern; in fact we were going to make one wing of our factory bigger, and it was going to be quite a big concern. But it fell through.

5408. (*Dr. Thorpe.*) Have you had any applications to make acetic ether commercially since?—Not since, and although we have had permission to do so, we have never taken it up. It fell through. It was looked into at the wish of the Government, but they found some other means of effecting their purpose and gave it up.

5409. (*Chairman.*) You yourselves have not used spirit in your business for the manufacture of fine chemicals such as alkaloids, and such like, have you?—No. We supply ethers for the people who make those kinds of things, such as collodions, and so on.

5410. I gather you do not think that even methylated ether would be used with advantage in the production of such things as tannic acid?—No: nor for collodions. Photographers will not use methylated spirit for this; it upsets their plates; it smears and puts a white coat over their plates, and so they will not use it.

5411. (*Dr. Thorpe.*) They use methylated ether though?—Yes, they use methylated ether, but they will not use methylated spirit.

Home Trade in Methylated Ether not affected by restrictions on Alcohol.

5412. (*Chairman.*) I understand that, as regards your firm, the point that really interests you is this question of the ether and the allowance that might be given to you in respect of the spirit used in making it when you export that?—That is our great point.

Mr. E. White
8 Feb. 1905.

Importation of pure Ether (*See ante* Q. 5331-64.)

5413. As far as your business with this country is concerned, that is, as far as concerns the home consumption, the present law and arrangements as regards alcohol do not bear heavily upon you, do they?—No, I do not think they affect us to a great extent. The only other question deals with the import of the pure ethers; that is a very important matter just now.

5414. You mean as regards the import duty?—Yes.

5415. (*Mr. Tyrer.*) You are now referring entirely to the importation of pure ether?—Yes. I was asked only a little while ago to quote to the Government for Schering's ether, which is a foreign ether. I said no, I do not supply any foreign ether myself. I quoted for our own make, but I was informed that we were entirely out of the price, although the Government themselves take Schering's ether and have it now.

Export of Methylated Ether. (*See also* Q. 5365-400.)Proposals for cheapening.

5416. The only point which I think needs emphasising now is this, namely, that you are perfectly clear about the 3d. per proof gallon?—To make it more exact I would rather say 6d. on the liquid gallon. I take it this way. The German spirit is 10d. and 5d. duty, that is 1s. 3d.; we are paying practically now 1s. 9d.; so if we get 6d. on the liquid gallon that brings it down to 1s. 3d. which is exactly the same as the German figure.

5417. (*Mr. Nicholson.*) But that is the price of the German spirit in this country; that is not the price of the German spirit in Germany?—But they have a certain duty on it in Germany, have they not?

5418. It is a very small duty as compared with ours?—I thought it was 5d.

5419. (*Chairman.*) The 5d. is the duty in this country when the German spirit is imported. As a matter of fact at this present moment in Germany spirit is dearer than it is in this country; but that is an abnormal state of things?—There is no foreign spirit coming in at the present moment; it is too dear to be imported now.

5420. (*Mr. Tyrer.*) The German price is 1s. 3d. less the 5d.; that is what they can produce their spirit at and their ether therefrom, when there is no question of its coming here?—Yes.

5421. Using Dr. Thorpe's phrase, you think a lesser quantity of wood naphtha might be used for the purpose of earmarking the spirit; as I understand, you would say that 5 per cent. rather than 10 per cent. might be used?—Yes.

5422. That would cheapen it a little, would it not?—I think that by reducing the naphtha you would make a lot of difference in the cost of the methylated spirit, as the naphtha is so much more expensive than the methylated spirit.

5423. In addition to that I suppose you have hope that alcohol for industrial purposes may have some still further concessions?—Yes, I hope so.

5424. How much do you think altogether you want to enable you to compete with German ether? Taking methylated spirit, which is the cheapest thing we have got, and assuming that we cannot get anything else but methylated spirit or spirit denatured in some way, what is the very cheapest in order to compete with the Germans, taking it at the proof gallon?—I said first 3d., but you say that is very near to it, if not rather too little.

5425. You will find that even your 6d. per liquid gallon will not give you what you want?—Still, it is a very serious thing that this trade should be drawn away from the country. I am certain this ether question will become a very much bigger thing in another five years.

Question of manufacturing Ether for export in bond. (*See ante* Q. 5397-9.)

5426. (*Dr. Thorpe.*) Does it occur to you that it would facilitate operations if you worked, at all events, some part of your ether manufacture in bond?—Would you make any further restriction upon us if we worked in bond?

5427. You would have to work under supervision?—Then you would want an Excise officer there. We have a great objection to an Excise officer being always on the premises. Not that we do not wish them to see us make ether, but there are various other things we make in our works besides things which concern the Government, and we have a great objection for anybody to see those. We want to keep those things to ourselves, and we do not like anybody coming into our works unless we can help it.

5428. It is a choice of evils. You want to get your spirit as cheap as you can, and the Board of Inland Revenue is anxious to meet you in that way, that is to say, to earmark the spirit, as it has been called, with the cheapest possible material which makes it safe for us, and puts you to the minimum cost. There are a variety of things that might be suggested, and the most certain is a proportionate quantity of wood naphtha, for the reason that has been stated, is it not?—Yes.

5429. But if we could get security in some other way, in other words, if we had the means to differentiate between the ether which was made from denatured alcohol and that which was made from pure alcohol, and on which you might claim a return of duty or a rebate, that, of course, would be to your advantage, would it not?—Certainly.

5430. What I am trying to thresh out is, how could we secure that?—You are speaking of its being made in bond; the Excise officer would have to come very early in the morning; he would have to be there at six o'clock in the morning when we charge our stills. It is no good his coming at 9 or 10 o'clock when we have got a good bit through the thing. We must begin in the early part of the day or we cannot get through in time; we cannot rush spirit through. As Mr. Tyrer said just now, it has to be done very carefully, and it takes a good bit of the day to manufacture.

5431. Is it not possible to devise conditions under which the whole thing could be practically done under seal, a definite quantity of alcohol being mixed with your sulphuric acid and put in your still and the products received under such conditions that the whole thing would be practically under seal?—It could be arranged that the spirit should be put into a receiver over night and sealed in the ether room by the Excise officer, or in some way like that. I do not see any other way in which it could be done. We are bound to start early in the morning in order to get our work done; it is impossible for us to do it otherwise.

5432. I am not prepared to suggest what the details should be, but I cannot think that it is an insoluble problem to work this mixture of sulphuric acid and alcohol under such conditions that practically it is not tampered with, and so that we could see that you got the proportionate amount of ether that you should get from it?—With regard to the amount of spirit, you would know pretty well by our permit books the quantity that we use, and you could see by your request books what we did with it. I do not see why it should not be checked in that way. The Excise officer comes and takes the books away from our factory every now and again. I think it could be checked in that way.

5433. That is to say, if we could devise methods by which all the ether upon which you claim £1 7s. 5d. for example, or whatever may be the equivalent amount, had been made from duty-paid spirit, then you would be free?—Do you not think that it might be done in some way by a check on a book? The makers of ether are not a large number of men. The firms in London are all men, I hope, of trust, and all respectable men. There are very few of us and we are men you can trust; we are not like men who are here to-day and gone to-morrow. You know us all.

5434. That is the answer that is always made; but then, of course, we have to look at it from a somewhat different point of view, namely, that anybody might ask for this concession and we might have no knowledge whatever of them?—There are, no doubt, certain difficulties in that way.

Ether for medicinal purposes. Question whether use of duty-paid spirit should be insisted on, as in Germany.

5435. Have you any opinion as to the desirability of insisting that all ether which is used for medicinal and strictly pharmaceutical purposes should be made from duty-paid spirit?—It always is made from duty-paid spirit.

5436. Is there not a large quantity of ether which is used, at all events in hospitals for anaesthetic purposes, which is not so made?—Yes. The question of the ether made from duty-paid spirit is a comparatively small one; it has no comparison with the other at all. It is a thing that we are not always making; it is a thing we only

make now and again. It is not a thing we are making like the methylated ether, every day in the week—we never stop making that; we are at it every day.

5437. The tendency, I understand, is for the pure ether made from duty-paid spirit to get less and less in amount?—Yes.

5438. In other words, even for purposes for which originally absolutely pure ether was insisted upon it is being more and more displaced by methylated ether, is it not?—Yes. I do not know that there is anything in that at all. I have often suggested to doctors when they write out their prescriptions that they should put "B. P." against their ether. In no prescription that you get from a doctor do you see "B. P."; he does not call it pure ether.

5439. (*Mr. Tyrer.*) The presumption is that a doctor is supposed to know his business, and therefore when a chemist gets a prescription from a doctor he is bound to assume that the doctor means pure ether whether he carefully defines it or not. In other words, putting it the other way, if the doctor says something other than nothing then he defines what he means, and if he says nothing but simply "Ether" it means ether according to the British Pharmacopœia?—Yes, that is so

5440. (*Dr. Thorpe.*) Are you aware that in Germany they have insisted that all the ether which is used for medicinal purposes shall be made from pure spirit?—Yes.

5441. Which means, in effect, duty-paid spirit?—Yes.

5442. We have not done so in England; do you think it is desirable that we should adopt that system?—I do not know why it should be beneficial for all pharmaceutical purposes; I do not see why it should be severely held to.

5443. In Germany the rule is that all ether which is sold retail across the counter of an apothecary shall be pure ether, and shall only be sold as the result of a physician's prescription?—I am aware of that. That is the very point I was thinking about when I referred to the doctor's prescription.

5444. (*Mr. Tyrer.*) You know perfectly well that the apothecary or the retail chemist in Germany is on a very different footing to his brother in England. Here anybody can go and say "I want some ether" or a certain mixture of ether and then the chemist proceeds to prescribe—sometimes very effectively?—That is so.

5445. So that the safeguard which applies in Germany does not apply here, unfortunately?—That is so.

5446. (*Dr. Thorpe.*) Should it not? Is it not to our interest and to everybody's interest that ether should only be sold under skilled direction?—Yes. We have often had inquiries even from ordinary chemists for a very large quantity of methylated ether; but not for pharmaceutical purposes. They have picked up an order for photographic purposes. I have had some very decent orders from some of these fairly sized chemists simply for photographic purposes.

5447. There can be no objection to that. This policy of the German Government is aimed at suppressing the habit of ether drinking. At present, as you know, people can go into any chemist's shop here and buy as much ether as they please, and if they choose to drink it outside, the chemist knows nothing about it, and need not ask any questions. That is not a very widespread vice with us, but still it does occur. Would not some system like that of the Germans, who insist that only what is a highly priced ether should be sold, and that it should only be sold by the direction of a physician, at all events minimise that evil?—Yes, it would certainly.

Mr. E. White.
8 Feb. 1905.

5448. Can you suggest from your experience as an ether maker any other form of denaturant which you think might be secure, and would not hamper you?—I do not think so; I think it is a pity to alter the naphtha which you now use without good cause.

Oil of Ether. Its use as a denaturant not considered practicable.

5449. You have a certain number of by-products in the manufacture of your ether, such as oil of ether; could you not denature your spirit with that?—We are only allowed to make oil of ether from the pure alcohol; we are not allowed to make it from methylated alcohol.

5450. Whether you make it from pure alcohol or whether you make it from methylated alcohol you get it?—Yes, certainly.

5451. Is there any commercial demand for it?—Yes, there is a small quantity used for making Sp. Aether Sulph. Comp.

5452. Do you make more of it than you can get rid of?—There is a very small demand for oil of ether. A lb. of oil of ether is a big order; and two lbs. would be a very big order.

5453. Then as a practical question that is not worth thinking of?—No.

5454. (*Chairman.*) You do get some oil of ether from methylated spirit, do you not?—Yes; we throw that away, as we have no further use for it.

5455. (*Dr. Thorpe.*) Do you not think it could be used as a denaturant?—I do not think so.

5456. (*Mr. Tyrer.*) It is very objectionable, is it not?—I do not like to have more to do with it than I can possibly help, especially if I am going out in the evening. You cannot wash it off your hands with soap and water.

5457. (*Mr. Scott Montagu.*) What do you do with it?—That which we get from methylated spirit we throw away; but that which we get from the pure spirit, as I was saying just now, we use for making our Sp. Aether Sulph. Comp. That is the only thing we are allowed to use it for now.

5458. Otherwise you let it run down the drains?—That which we get from the methylated spirit we are not allowed to use and we are not allowed to sell. I believe that it was used some years ago, but it was stopped.

5459. Why were you prevented from using it?—Some years ago the Sp. Aether Sulph. Comp. was made from the ordinary oil of ether; but the Excise or somebody on the part of the Government came down, and we were particularly told that we must not do it. That was a long time ago, I think over fifteen years ago.

5460. (*Mr. Tyrer.*) I had a broad arrow put on six quarts of mine?—Yes; I believe it came from you, though I did not like to mention the name.

5461. (*Chairman.*) Do you use the same set of vessels for making the pure ether as you do for making methylated ether?—If we are very busy. When we are not busy we keep plant specially for pure ether; but if we are driven then we have to use the whole lot. But we are always very careful to see that everything is washed right out. We keep a special still for the pure ether. As we have been driven lately, we have of course not been able to do that, but we are always very careful that the vessels shall be quite clean.

Plant for making pure ether sometimes used for methylated ether.

Mr. Joseph Cash, called; and Examined.

5462. (*Chairman.*) I think you have come to speak to the Committee on the subject of artificial silk?—Yes.

5463. Are you engaged at present in the manufacture of artificial silk?—No; it is not carried on in England, I believe, at the present time.

Artificial Silk The Coventry Enterprise (1898 to 1900), and its abandonment

5464. Were you connected with the attempt that was made some three or four years ago at Coventry?—Yes.

5465. For how long was the factory open, and how long was it working?—I think it was for about two years that the experiments were carried on.

5466. And then you abandoned it; on what account? It was abandoned partially on account of not being able to get the use of duty-free alcohol; but there were other reasons that necessitated the abandonment of it.

Mr. J. Cash.
8 Feb. 1905.

5467. What was the mixture that you used for dissolving the gun cotton, the pyroxylin; what proportion of ether and alcohol did you have; was it 60 per cent. of ether and 40 per cent. of alcohol?—I think that was about it, but I do not think it was given in the paper which I read before the Society of Arts. I know that my

Mr. J. Cash.

8 Feb. 1905.

co-directors said that they did not wish me to disclose too many facts on the manufacture.

5468. It was at any rate a mixture of ether and methylated spirit that you used ?—Yes.

5469. And the methylated spirit was the ordinary methylated spirit, containing 10 per cent. of wood naphtha ?—Yes.

Methylated spirit found unsuitable.

5470. Did you come to the conclusion that that 10 per cent. of wood naphtha injured the spirit for your purposes ?—We did. We made experiments. We paid duty on a certain quantity of pure alcohol, and I think you will find a report from the Coventry Inland Revenue Office after the experiment was made to the effect that the use of methylated spirit acted prejudicially on the silk produced. The result of using pure spirit made the silk almost indistinguishable from the real article. The strand was closer the gloss almost perfect and the strain capability considerably greater. Then in another paragraph of the report it is said that regulations should be framed. We offered to make regulations to safeguard the Revenue from fraud and we offered to erect a distillery specially for the production of the spirit, and consented to pay the cost of Revenue supervision. We asked that it might be favourably considered.

5471. What was the date of that ?—That was in 1900.

5472. When did you abandon the enterprise ?—It was abandoned about December 1900 or early in 1901.

5473. You say there were other reasons, but I do not want to ask you what the other reasons were, unless you are inclined to tell us. Should you consider that apart from those other reasons the obligation to use methylated spirit would of itself oblige you to abandon the enterprise ?—I should hardly like to say that. The difficulty was, getting wet silk ; whether that came from the methylation entirely or not I am not prepared to swear.

5474. Do you remember what particular form of gun cotton you used ?—A tri-nitro-cellulose.

5475. How would that correspond with what is called ordinary gun cotton as used for explosives ?—The ordinary gun cotton is not soluble in alcohol. In my paper I said that the tri-nitro-cellulose is most satisfactory.

5476. It is possible that the character of the gun cotton used might have had a considerable influence upon the manufacture ?—This report of the Chairman after I left the Company seems to point rather to that. I have no objection to your seeing this report if you like. I do not know whether you have had it in your hands. (*See* page 216).

5477. I do not think I have. Perhaps you would read to us what he says on this particular point ?—In this report which Mr. Rodakowski made he says, "I believe the opinion had gained ground amongst the directors and officials that the main thing barring our way to success, was the impossibility of closely following the precepts of Besançon "—that is the large works in France —" by using pure alcohol in connection with ether for the solution of nitro-cotton. The laws of this country would not allow us the duty free use of pure alcohol without methylation, and steps were then taken to secure this permission from the Government. Without going at great length into this question, suffice it to say that these steps were not successful. The principal chemist of the Government laboratories gave it as his opinion that the methylation of pure alcohol with pure methyl-alcohol or wood-naphtha could not be injurious to our process, and with the object of ascertaining the correctness of this contention an experiment was undertaken at the end of March with alcohol methylated on our premises. The first experiment was considered unsatisfactory and inconclusive, owing to the limited amount of alcohol at our disposal free of duty (I believe .300 gallons). On April 9th, Messrs. Scott, Nye & Westermann "—gentlemen who were directors—" went to the principal Government chemist, discussed the matter with him and obtained a new permit for 500 gallons, to which gradually additional permits for a total of 1,250 gallons were added." I was entirely against this myself, and it was partly on that account that there was a split with me and my co-directors. I knew from what I had gathered when visiting Besançon and from the study that I had made of this that it was no use going on with methylated spirit ; and I practically told the chemist at that time that he knew nothing at all about it, that it was a patent, and a lifetime had been spent in working this artificial silk process out and I did not consider he was a competent judge, upon which of course he was naturally very angry.

5478. Of whom are you speaking now—of the Government chemist ?—Yes.

5479. (*Dr. Thorpe.*) No, you are speaking of your own chemist, Mr. Ollerenshaw ?—No, I was not ; I was thinking of the Government chemist.

5480. You never said anything of that to me.—My co-directors think that I behaved rather badly, but I was under the distinct impression at the time that the silk could not be made with methylated spirit.

5481. (*Chairman.*) What was your ground for that ?—There were acetones and other things in the wood naphtha that were injurious to the silk. I do not know whether my view was correct or not.

5482. Is it not the case that the parties from whom you obtained the licence and the patent stated that so far as they were aware there was nothing in the methylated spirit that would militate against its suitability for the purpose ?—I never heard that. I had many interviews with Count Chardonnet and he said : you must use exactly the same thing we use—the pure alcohol—and even to the cotton waste itself you must use that. We even went to the trouble and expense of getting this special cotton that they use from the Continent, but that in my opinion had not any bearing on the subject at all. Cotton was cotton as far as I could see in making the collodion ; but still we did it.

5483. Then I understood you to say that the directors were of opinion that you had not got the right cotton ; is that so ?—In the first instance ; afterwards we considered that we had got the right cotton.

5484. (*Dr. Thorpe.*) Did they admit that you had the right cotton ?—It says in this report that they found the cotton waste satisfactory after getting it from abroad.

5485. I understood you to say that you did not think there was anything in that conviction of theirs that you were not using the right cotton ?—I did not think so myself.

5486. Your opinion was that you might have used the cotton that you had previously been using ?—Yes.

5487. All cotton was cotton ?—Yes, if it was treated in the same way. I based that on my textile experience.

5488. But all alcohol is not alcohol ?—No, not when it is methylated.

Experiments with Wood Naphtha of high purity as methylating agent. (*See also Q.* 5506-16 and 5565-89.)

5489. (*Sir W. H. Holland.*) I did not hear what was the effect of these lots of 500 gallons that you mentioned. —The report proceeds : "As an outcome of the discussion with the Government chemist, steps were taken to secure the purest wood-naphtha procurable in the trade. My appointment coincided with the preparations for this experiment, which at that time was considered to be the final one, the Directors understanding that, should it not prove successful, the Government would then grant us permission to use pure alcohol duty-free for our manufacture." We were under that impression. Mr. Hanbury gave me every encouragement when I went to see him on the subject and we quite thought that we should get it. The experiment was commenced on April 23rd.

5490. Is that 1900 or 1901 ?—1900. "Since then further interviews with the Government officials have convinced us that there is but very little hope of our getting this permission within a reasonable time, even should we succeed in proving that the use of pure alcohol is indispensable." It was thought at that time that pure alcohol was not absolutely necessary. "The experiment was commenced on April 23rd, with cotton declared to be very good, the purest procurable wood-naphtha for methylation, and acid of a specially approved formula. We were at once confronted with the difficulty that the nitro-cotton would not give the proper test results. The chemist hoped, however, to correct this as we went on, experience having shown that the acid did not readily yield to any alteration in the proportions of its composition. The collodion we produced was clear and thoroughly satisfactory, and it started to spin extremely well, which result was especially gratifying, as all experts agreed that even the best collodion required to run for some time through the pipe system before spinning well.

For this reason also no weight was attached to the fact that a certain number of the bobbins spun were too wet and sticky and in consequence difficult to wind?"—— I thought it was on account of this methylation.

5491. (*Chairman.*) Would you mind continuing to the end of that and then let us see when it began to fail?—We had already tried the pure alcohol before this

5492. I gather at first that the experiment with methylated spirit was extremely promising?—Yes.

5493. Then what happened?—"The manager and Chemist, justified by previous experience, expected that this would get better as we went on; instead of doing so, however, it grew worse."

5494. To what was that due?—That was the stickiness and the not spinning well. "Various suggestions were made for the remedy of this difficulty, and many explanations were offered by the experts. As all these, however, were guesses and not certainties, we decided without stopping the spinning to look for the explanation successively in every part of the manufacturing process." That appears to be all there is about the alcohol. The other part is about the other processes of manufacture, which if you like I will go into.

Difficulties unconnected with alcohol. (*See also* Q. 5628–42). The experience of French and German factories.

5495. As regards the other reasons for abandoning the enterprise, were any of them of such a kind that they would have been conclusive, irrespective of this question of the alcohol?—You see, I was no longer in the company when it was given up and I could not quite say what it was; but they were not successful in turning out large quantities.

5496. They could turn out small quantities, could they not?—Yes; they were spinning, I think they state in this report, about 76 lbs. per day.

5497. It is a very delicate operation, is it not?—It is most delicate.

5498. We have just had the advantage of seeing an artificial silk factory in operation in Germany. Although that has been open for more than two years it was only within a week of our visit that the manager was able to feel confident that he had really overcome all his difficulties. He had encountered numerous difficulties, not one of which was connected with the alcohol, and it had taken him more than two years to arrive at what he thought was a satisfactory result?—It has given me many weary hours.

5499. (*Dr. Thorpe.*) Perhaps you could tell us how long the Besançon people were before they got into proper working order?—I could not say how long, but it was several years.

5500. Although they had pure alcohol?—Yes.

5501. (*Mr. Scott-Montagu.*) Were the difficulties in their earlier years at Besançon in any way connected with alcohol?—No, I believe not, because they had pure alcohol to begin with.

5502. It could not have been the alcohol in their case because they did not have any methylated spirit, so that you cannot say anything there to the alcohol?—There it had nothing to do with the alcohol.

5503. (*Dr. Thorpe.*) But the difficulties at Wolston were set down to the alcohol because there was a difference between their alcohol and that used at Besançon?—Not all the difficulties—I will not say that. The temperature had a very great deal to do with it—and the collodion.

5504. And the hydration of the alcohol, the strength of the alcohol?—Yes; and in fact, the acids themselves.

5505. The acids used to nitrate the cotton, do you mean?—Yes; if the sulphuric acid is not exactly as it ought to be—and there are many samples of very impure sulphuric acid on the market—even that, I think, had something to do with it.

Experiments with special quality of methylated spirit. (*See ante* Q. 5489–94 and *post* Q. 5565–89). Encouraging results obtained.

5506. Did you not eventually in your dilemma call in the aid of some persons from the continent to help you?—We had a chemist from the continent who was appointed as chemist there.

5507. That is to say after you parted with the services of Mr. Ollerenshaw you got somebody else, did you not? Yes, on the advice of the chairman who followed me.

5508. You had some difficulties, you told us, with the wood naphtha, which you originally got?—Yes.

5509. It was not quite in accordance with the wood naphtha which it was suggested to you you might try?—That is so.

5510. Eventually you got a kind of wood naphtha which was more nearly in accord with what it was suggested you might try?—Yes.

5511. When you had that kind of methylated spirit, you had also, I believe, the services of this gentleman to whom you have alluded?—Do you mean the Swiss or the German?

5512. I understand he was a Swiss?—That was Mr. Westermann. Do you mean the chemist or the man who was manager at the Spreitenbach Works? Both those gentlemen came to us afterwards. I forget the chemist's name now, but I think the thing drove him mad, at any rate, poor fellow, he committed suicide afterwards.

5513. During that time, or after he left your company?—Just directly after he left our company.

5514. These gentlemen, either one or both of them together, were successful in making this material from this character of methylated spirit?—It was very much better.

5515. They certainly assured me that all their difficulties as regards the methylated spirit, that is the mere question of the kind of alcohol, had been overcome?—Did they? I was not aware of that. I do not think I was chairman at the time.

5516. You may take it from me that they did?—Certainly I do, if you say so.

History of the Coventry enterprise. Foundation of the Company in 1898.

5517. They came to me and assured me that such was the case. If you will allow me, we will go through this thing from the beginning to the end. The original company, which was called "The New Artificial Silk Spinning Company," was founded in 1898, I think?—That was called "The Artificial Silk Company."

5518. I believe the title of it was "The New Artificial Silk Spinning Company"?—No, "The New Artificial Silk Company" came afterwards on reconstruction.

5519. Was not "The Artificial Silk Spinning Company" the proper title?—I think it was "The Artificial Silk Company."

5520. However, there was a company with some such name as that founded in 1898?—Yes, there was.

Permission to use unmineralised methylated spirit applied for and granted.

5521. That Company was allowed by the Excise authorities to use 80,000 gallons annually of unmineralised methylated spirit. Were you chairman of that company; were you connected with the first company?—I was, but that is not the first company, I think.

5522. Were you connected with the 1898 company?—Yes.

5523. You do not perhaps remember that you were permitted by the Excise authorities to use 80,000 gallons annually of what we call unmineralised spirit, that is methylated spirit without petroleum added to it?—I remember that.

5524. If you were informed by those who gave you the concession to work this that it was an absolute necessity to use pure alcohol, why did you apply for permission to use unmineralised methylated spirit?—Of course there was a great deal at stake, and we supposed that it was quite right to try what we could do to save the shareholders' money. You, I believe, afterwards said—of course that was not the reason—that we could use the methylated spirit; so we were not very far out in saying so.

5525. I will come afterwards to what I said; the point was that you made an application to use unmineralised methylated spirit?—Yes.

5526. And you were allowed to use it to the extent of 80,000 gallons a year?—Yes.

5527. Do you know whether there was anything in your articles of agreement with the persons who allowed you to work under their patent rights, whatever they were, to the effect that there was nothing detrimental or objectionable in such alcohol as you could obtain under the English regulations?—There was not anything.

Mr. J. Cash.

8 Feb., 1905.

5528. There was nothing of that kind ?—No.

5529. Was I misinformed, therefore, when I heard that persons connected either with this particular company, or with the company as it was after you left it, intended in view of their proved inability as they thought to make the silk from alcohol, as they could alone get it in England, to claim damages from the owners of the patent rights for misrepresentation ?—I did not hear of that.

5530. Do you say that that did not occur ?—I do not remember it. Was that in 1900 ?

5531. I may be able to find it incidentally in the case, but you do not know that it was mooted in the directorate whether they should go back upon those people and practically claim, I will not say damages, but, at all events, wind up the concern and claim what they could get on the ground of what practically amounted to mis-representation ?—I cannot recall that. I do not remember hearing anything of it. I have tried to carry my mind back in order to help you as much as possible, but I do not remember it.

Reconstruction of the Company in 1899.

5532. This company, which you say was not the first company, the company of 1898, I think went into voluntary liquidation in 1899 ?—Yes.

5533. Was that on account of their failure to make the silk ? Why, might I ask, did they go into voluntary liquidation; what prevented them from going on ?—Want of funds.

5534. The company, however, was reconstructed, was it not, in 1899 ?—Yes.

5535. As "The New Artificial Silk Company" ?—Yes, that is it.

5536. I think I am right in saying that it was originally called "The New Artificial Silk Spinning Company," and the sole distinction between the two is that the new company was called "The New Artificial Silk Company"; however that is a detail. Now "The New Artificial Silk Company" acquired the privileges of the old company in regard to methylated spirit, did they not ?—Yes, I suppose so.

5537. The Revenue authorities transferred to them the privileges which the old company had ?—Yes.

Application for permission to use pure, duty-free, spirit unsuccessful. (November, 1899).

5538. On the 18th October, and in a subsequent letter of the 6th November, 1899, the directors of the new company petitioned the Board of Inland Revenue to be allowed to use pure alcohol, alleging that methylated spirit was unsuitable for their manufacturing operations ?—Yes.

5539. And stating what was perfectly true, that in France and in Switzerland pure alcohol denatured with ether only was used ?—Yes.

5540. Of course you do not know what happened immediately on that application ?—No.

5541. For the information of the Committee perhaps the Chairman will let me tell you exactly how that application of the company was dealt with. The company's application was referred to the Chief Inspector, Mr. Lambert, who suggested that an application might be made to the Treasury for permission to allow pure alcohol mixed with ether to be used in the manufacturing operations as an experiment for three or six months. The Board of Inland Revenue having consulted their solicitor, and being advised that the concession asked for could not be granted by them under the existing law, and being informed by the Customs that the levying of a countervailing duty was impracticable, laid the matter before the Treasury on the 11th December, 1899. The Treasury after fully considering the matter declined to sanction the use of ether as a denaturing substance, and requested the Board of Inland Revenue to consult their chemical advisers and to confer with the company's experts to see whether a suitable denaturant equally acceptable to the Revenue and the company could not be found. The Board remitted the papers to me and requested the company to send representatives to discuss the matter with me. On the 12th March, 1900, I think I had an interview with you, with Mr. Moss, your then manager, and with Mr. Ollerenshaw, your chemist ?—Yes.

Question of a suitable denaturant discussed by Company's experts and Principal of Government Laboratory. (March 1900).

5542. I addressed a report to the Board of Inland Revenue on the subject of our interview immediately after it had occurred, and perhaps I had better read that Report ?—I remember carrying those negotiations on through the Inland Revenue Department here in this building myself for many weeks.

5543. I have here the Chief Inspector's original submission, the correspondence with the Treasury as to the practicability or otherwise of a countervailing duty, the Solicitor's opinion, the submission of the Board to the Treasury, and the Treasury's answer. This is my Report to the Board:—"I have to-day seen Mr. Cash, the chairman of the above named company"—that is "The New Artificial Silk Company"—"together with his manager Mr. Moss, and the chemist of the works, Mr. Ollerenshaw, as to the use of pure alcohol duty-free in the manufacture of artificial silk. Artificial silk is made from collodion. That is a form of nitro-cellulose dissolved in a mixture of alcohol and ether. Ether is necessary to the process. The real point is whether the alcohol should or should not be denatured by wood naphtha." I gather you raised no objection to ether made from methylated spirit ?—No, we did not find any objection if it was made from methylated spirit.

5544. Were you not aware that the ether you were buying was made from methylated spirit ?—No, I was not aware of that.

5545. Had you been aware of that do you think you would have objected ?—No, I do not think I should— if the result was satisfactory I should not.

5546. May I point out that that is a very serious departure from the Besançon example which you said you could alone follow ?—I do not know what the Besançon ether is made from, I am sure.

5547. It is not made from methylated spirit ?—Would all what we call the objectionable acetone and other things pass over in the ether in the distilling of it ?

5548. Of course you are begging the question as to whether the acetones and the rest are objectionable ?—I only want to point out where my objection is.

5549. The point is that you were unwittingly using methylated ether, apparently ?—Yes.

5550. So that, at all events, you did not put any blame on to the methylated ether; it was solely the methylated alcohol ?—It was only to what it contained; that is all. It was not the name.

5551. I will continue to read my report:—"I am assured by Mr. Cash that no objection is raised on the ground of the cost of the denaturing." You remember when we first met we had an idea here, because we ourselves could not really discover why a properly selected methylated spirit should be detrimental, that the real reason of your application was to secure a cheaper form of alcohol than methyated spirit ?—Yes, and I think I told you, and I think you had it from the company, that that was not it at all.

5552. Quite true; I remember we spent some little time in discussing that; I tried to elicit how far that was or was not the case, and you assured me that the anticipated profits of this manufacture were so considerable that what you thought the relatively slight difference in cost between methylated spirit and pure spirit did not enter as a factor into your calculations ?—That is so. I think it was about 5d. per gallon, was it not ?

5553. Whatever it was ?—It was of no consequence to us, I know.

5554. You thought it was of no consequence to you at that time ?—Yes.

5555. "I am assured by Mr. Cash that no objection is raised on the ground of the cost of denaturing. He alleges that certain matters in the wood naphtha affect the character of the thread, but he has no certain knowledge as to what these substances are. The manager of the company thought the deleterious substance might be acetone; the chemist that it might be acetic acid or fusel oil or resinous matters. I pointed out that none of these substances is of necessity present in wood naphtha as used for methylation"—in other words there is nothing like acetic acid or fusel oil or resinous matters in methylated spirit, and certainly not in such methylated spirit as you were permitted to use. Mr. Ollerenshaw—I do not wish to speak disrespectfully of him in any way—seemed to have a very vague idea as to what methylated

spirit did contain. Mr. Moss on the other hand, as I reported to the Board, seemed to think that really the deleterious thing was the acetone; I think that agrees with your own surmises too, does it not?—Yes.

5556. "I pointed out that none of these substances is of necessity present in wood naphtha as used for methylation; in other words that the company could control the character of the wood naphtha to be employed in their operations by purchasing a suitable article. It is suggested therefore that the company should methylate their own alcohol by wood naphtha, which their own chemist would test in the first instance, and which should be approved by us. I understand that the company will make application to be allowed to methylate their alcohol on their own premises, and I trust that under the circumstances the Board may be pleased to sanction such relaxation of the regulations as may meet their special case." That was the Report. You went to work upon those lines, I think?—Yes. I know you very kindly told us of the very best naphtha, the purest form that you knew of.

5557. Do you remember sufficient of that interview; can you recall it all?—I should not like to say I could recall it all. You have perhaps notes that refresh your memory.

5558. Can you recall those somewhat disparaging remarks you made with respect to the knowledge of the Principal Chemist of the Government Laboratory? Was it on that occasion that you ventured on those remarks?—I believe I only came to see you once.

5559. I had several interviews?—Yes, with others, but not with me.

5560. My recollection is that you were extremely courteous and polite, and that you made no reflections at all upon my ability or my desire to try and deal with your difficulty?—Of course the whole company were looking up to me, and I was very annoyed at the time, that I could not get my way about the alcohol, after being almost promised by Mr. Hanbury that I should have it. That was my difficulty. I was perhaps a bit hasty in my earnestness on the point.

5561. I am sorry to say anything against the memory of Mr. Hanbury, but it is a very great pity that the letter which Mr. Hanbury sent—it is his own signature here—to this Board was most emphatic about the impossibility of your getting pure alcohol, and using ether as a denaturant?—I knew that at the time when I went to see Mr. Hanbury, that my co-directors were most indignant because I went to see him without a proper deputation; but he said: "I am glad you have come alone; I do not want any deputations; give me the whole history of it."

5562. There was very little encouragement from the Treasury?—Very little to you.

5563. (*Sir W. H. Holland.*) And still less to you probably?—They gave me great encouragement.

5564. (*Mr. Scott-Montagu.*) Was the encouragement that you got from Mr. Hanbury written or only verbal?—It was only verbal.

Board of Inland Revenue authorize experiments with spirit methylated at the factory with wood naphtha of high purity. (April, 1900.) (*See also* Q. 5587–9.)

5565. (*Dr. Thorpe.*) I think as the result of this interview it was agreed that the company should be allowed to methylate on their own premises, and that as pure a wood naphtha as possible should be sanctioned for such methylation?—That was so.

5566. I think you made one or two attempts which were not very successful to obtain a suitable wood naphtha?—Yes.

5567. Then again you came to me to ask how I could help you?—Yes.

5568. I directed you, I think, to put yourself in communication with Messrs Lister and Biggs?—I do not remember the name of the firm now. It was a foreign naphtha, I believe—only they procured it.

5569. Prior to that, however, this is what your company said to the Board: "Sir, with reference to yours of the 8th instant"—this is addressed to the Secretary of the Board of Inland Revenue—"we beg to say that we have had a consultation with Dr. Thorpe, and discussed the various points that are inimical to our process in the denaturing of alcohol with naphtha. Dr. Thorpe has consented that we should be permitted to methylate, as an experiment with a naphtha that is chemically free of all other ingredients than methyl alcohol, in order to see if it should answer our purposes, and this will be done in view of the fact that we add 60 per cent. of the ether to the alcohol that we use, which he considered was part of the methylation. He further suggested that the methylation should take place at our own works, in order that we might have the assurance that the naphtha is free from all objectionable matters. We therefore beg you to give us the necessary permit to have some pure ethyl alcohol delivered at our works duty free, and also liberty to have it methylated under the supervision of your officer at the works. In view of the experimental nature of this indulgence, we beg you to permit us to have the minimum quantity of alcohol delivered here for methylation that would serve the purposes of the experiment, say 150 gallons, and further we beg you to allow us to have it mixed in the storing tanks which we have on our premises, having a capacity of 500 gallons each." The Board of Inland Revenue acceded to that, I think, at once?—Yes.

5570. Now, having got over your difficulties as regards the character of the wood naphtha, you were supplied, I think, by Messrs. Lister & Biggs with wood naphtha, and you actually denatured between the 24th April and the 5th July, 1900, 2,500 gallons of alcohol?—Something of that sort I think it was.

5571. And that you methylated with this special wood naphtha under the temporary arrangement sanctioned by the Board?—Yes.

Encouring results of these experiments.

5572. About April and May you were getting this artificial silk fairly successfully?—We were spinning it.

5573. You thought, at all events for the moment, that you had overcome a great many of your difficulties that could be attributable to the alcohol?—Yes, we did.

5574. I am right, therefore, in saying, from the information I have got, that the results were quite satisfactory as regards the alcohol. Two of your chemists, who visited the laboratory for information as to the methods of examining wood naphtha, came to ask us for information as to how we did it?—Yes, I remember that.

5575. They reported that the new methylated spirit was working satisfactorily, and that the difficulties still found in your manufacturing operations were in their opinion due to mechanical defects in the apparatus used. Are you able to subscribe to that?—I cannot say that—no, I cannot agree with that, because I do not think it was due to mechanical defects. I believe the mechanism was perfect. It was due to something else.

5576. Then the company's manager—that was Mr. Moss—also came up to town, and he expressed himself satisfied?—Yes, I believe he did.

Permanent authority to methylate at factory applied for. (May, 1900.)

5577. As a consequence of that about the middle of May—that is on the 18th May, 1900—after an interview at Somerset House, he applied on behalf of the company for permanent permission to methylate at the works; in other words, they were so far satisfied that they now wanted to put the thing on a permanent basis?—Yes.

5578. He promised to have the necessary buildings, vats, etc., at once erected?—Was that in December, 1900?

5579. That was in May, 1900?—That was about the time that I resigned.

5580. You resigned, I think, in consequence of a difference of opinion with Mr. Moss and others; Mr. Moss was satisfied and you were not?—Yes.

5581. You parted company on this very question, you told us, or very largely on it?—Yes, on the non-success of it, really.

5582. Now let us be quite frank with one another. Whereas your two chemists and your manager came up here, and expressed themselves satisfied with the arrangements as regards the alcohol, you still adhered to your original opinion that you could only be successful if you got what you call perfectly pure spirit; and on that difference of opinion you, as you have told us, practically seceded from the concern?—Yes, that and other things. That was one of the reasons.

5583. (*Sir W. H. Holland.*) And probably the ultimate result may confirm you in the opinion you then held?—Well!

Mr. J. Cash.
8 Feb. 1905.

5584. (*Dr. Thorpe.*) I think Mr. Cash saw what was coming?—It was not that. I am certain that the works were thoroughly equipped. It was the chemists, I think, who were at fault.

The application not followed up.

5585. Let us pursue this: The Board of Inland Revenue were willing to sanction these permanent arrangements as to the methylation; we all thought practically you had turned the corner and got over the difficulty, and we were willing then to sanction these permanent arrangements. We heard nothing about it, and on July 5 the supervisor was instructed to press the company to submit the plans for the permanent buildings for methylation. I think, perhaps, you cannot speak to this, because in July you had gone?—I was not on the Board then.

Liquidation of the Company. (July, 1900.)

5586. We did not hear anything from the company about these permanent buildings which they desired to put up, and the supervisor was then asked to enquire what was going to be done. But nothing was done by the company, and on July 31 the supervisor reported that the company had gone into liquidation and that operations had ceased. That is practically the history of the Wolston Company, is it not?—Yes.

Character of the specially methylated spirit.

5587. The Chardonnet Company obtained possession of the premises, did they not, in succession to the New Artificial Silk Company?—I do not know anything at all about it, except that there was a company formed called the Commercial Enterprise, which I think took it over.

5588. Anyhow, the liquidators came into possession of a relatively large quantity of what we should not consider as ordinary methylated spirit, did they not?—That I do not know.

5589. That is a fact; I mean to say it was so pure that we could not allow it to go into ordinary consumption without being specially denatured?—I do not know anything at all about the company after I severed my connection with it—nothing except what is in this report.

5590. (*Chairman.*) The evidence seems to point to this, that while you personally retained to the end a strong opinion that methylated spirit was prejudicial to the success of the enterprise, there were other people connected with the enterprise who were satisfied that methylated spirit was not of itself a serious objection?—I think it all points to that.

Process of manufacture. Little risk of misuse of spirit by workmen.

5591. Let us go for one moment into the methods you employed. Assuming that some special method of denaturing had been permitted which you found was suitable, the spirit, I take it, once it had been denatured, would have been kept in a tank reservoir?—Yes.

5592. From there it would have been conveyed into the vessel in which the gun cotton is dissolved in the mixture of ether and alcohol?—Yes.

5593. That would be the next step with it; the alcohol would be conveyed into that vessel, and mixed with the guncotton and the ether, practically in closed pipes?—It was done so. We had reservoirs not connected with that building for denaturing.

5594. How long would it remain in the dissolving vessel?—I think it is twelve hours. It is given in my paper.

5595. The dissolving vessel would be closed up?—Yes.

5596. Once the spirit had got into the tank reservoir, from that moment there was practically little or no opportunity for any workman about the place to get at the spirit; was that not so?—That was so, but I must tell you that almost directly the spirit gets with the nitro-cotton no one would care to drink it, as it is partially collodion then; it gets into that thick state because it dissolves some of it at once. They could get at it, because there is a lid like a man-hole lid to a boiler for them to open and look in to see if it is thoroughly dissolved.

5597. My point is this—that in this particular manufacture the alcohol that is used is used under such circumstances that there is really not very much reason to apprehend that it can be tampered with by the people in the factory?—That is my opinion; and it is in my opinion of that strength that any one drinking it would soon become so intoxicated that he would do it once and not again and get discharged, if it did not kill him. It appears to me that in a process like that the alcohol is the same as silk or any raw material in any factory. If people are caught stealing it—and they can be detected—it is treated as a theft, and they are discharged. As to taking it away, of course that is very serious.

5598. You consider that the conditions of manufacture are such that it really is hardly necessary to render the spirit unpotable?—That is my opinion.

5599. Provided it could be safely protected until it was in the locked reservoir, from that point onwards it is hardly necessary to render it unpotable?—That is my opinion.

Success of the Artificial Silk industry on the Continent

5600. (*Sir W. H. Holland.*) I suppose you admit that this artificial silk manufacture at Besançon is very successful now?—I believe it has become very successful. They lost money for years.

5601. Do you admit also that it is a very successful industry in Germany?—I cannot say for certain. I know that the quantities used in this country for manufacturing purposes are enormous.

5602. And the presumption is that there are still greater quantities used in Germany because there are more silk manufactures there; is that not so?—It is hardly right to say there are more silk manufactures, because I do not think it is at all in those goods; it is more in trimmings such as they make at Plauen, in Saxony, and that district. I know there is a factory in Belgium and one in Germany, one in Switzerland, and one or two in France. The quantity of this artificial silk that is used is enormous.

5603. Have you heard that they are making large profits in these various factories and are extending them every year?—When I read my paper in 1900 I had just been over the Besançon factory, and I know that they were going to extend it so as to produce 7,000 lbs. of this silk per week.

5604. Do you know anything of the Glanzstoff factory at Aix-la-Chapelle, which is a very large factory?—No; I suppose that is the German factory. I believe that nearly all the machinery that was put down at Wolston for making this artificial silk went to Germany. It was nearly all aluminum.

5605. (*Chairman.*) We saw some of it.—Then you know more than I do. I suppose they thought the aluminium was very satisfactory.

5606. They are quite satisfied, only it is now in a factory at Jülich, not far away between Aix-la-Chapelle and Cologne?—We have lost a great industry in this country in the matter of this artificial silk.

Number of operatives employed.

5607. (*Sir W. H. Holland.*) It employs large numbers of operatives, does it not?—Yes.

5608. Therefore its non-success in this country is a very serious misfortune to British labour?—I should say so. The Welsbach Incandescent Mantles are made of artificial silk; it is considered the best medium for holding the rare earths, unless they have altered their mode of manufacture.

5609. Have you any information as to the number of hands employed in the artificial silk industry generally?—No.

5610. (*Dr. Thorpe.*) How many hands did your factory employ at Wolston?—That I do not remember now.

5611. (*Sir W. H. Holland.*) I have seen one factory where they are employing 800 and they are proposing to double the size of it, because they are making such enormous profits?—I know there is a large quantity of this artificial silk used in England.

5612. The principal market is on the Continent, is it not?—At Leek, in Staffordshire, there is a large quantity used.

5613. They are also establishing factories in Belgium. If this venture had been successful in this country there is no reason why many thousands of work-people should not have been employed in this industry by this time. Are you aware of any other advantages which they had at Besançon which were denied to you in Coventry beyond the one of pure alcohol; I suppose in other respects you were on equal terms?—I think so.

5614. Therefore if they overcame all the other difficulties you, with similar industry and ability, ought equally to have overcome them here?—Yes. There is one advantage I think that they had.

5615. What is that one?—I think the employment of women at night. I believe they are allowed at Besançon to employ women at night, but I am not quite certain. This process ought not to be intermittent, it ought to be continued night and day, and the temperature of the spinning rooms especially must be kept even and dry.

5616. Still you can employ men at night?—Yes, we could keep men by night. It is a most delicate operation.

Prospects of restarting the industry. (*See also* Q. 5643–9.)

5617. If you were told that you could have duty-free alcohol now to make a fresh start with this industry in this country, with your past experience would you be disposed to look favourably upon it, or do you think that there are men who would look favourably upon it?—I should not like to tackle such an awful job again in my life. Once is enough for one life-time. It is something terrible. I never had anything to do with such a difficult thing before.

Causes of failure.

5618. The impossibility of obtaining duty-free alcohol has added enormously to your difficulties?—In my opinion—and I must adhere to it whatever is said to the contrary—I still think that if we had every advantage like they have at Besançon we should have been better off.

5619. We had from a previous witness, Mr. Reid, that he had had a conversation with Chardonnet's engineer, and Chardonnet's engineer said that in his opinion the real ground of the failure of the Coventry firm was that they could not get duty-free alcohol?—I am glad there is someone to support me, and that I am not quite alone; still it may be only theory on my part.

5620. (*Dr. Thorpe.*) May we add to that the testimony of Dr. Bottler, the Managing Director of the factory we saw at Jülich? He said that whilst alcohol might be a factor, that was not by any means the particular reason which brought down the Wolston concern?—I have not said that it was.

Selling price of artificial silk.

5621. When you were making artificial silk at Wolston what sort of price per lb. did you get for it?—I do not recollect.

5622. Have you any idea what the price per lb. now is?—No, I have not.

5623. (*Sir W. H. Holland.*) I think someone told me that it was 12s. per lb., which would be just under-selling silk, and that they can make it for a fraction of that?—They cannot buy any silk at 12s. per lb. unless it is in the raw state, and then it has got to be boiled off.

Quantity of spirit used in making a pound of silk.

5624. (*Chairman.*) Do you remember what quantity of ether and alcohol was required to make 1 lb. of silk?—No I do not, but I have those particulars at home, and I think I could find them.

5625. At any rate it is a very large quantity of alcohol that is required to make 1 lb. of silk; the ether originates in alcohol, and then you have a mixture of ether and alcohol, so that the total quantity of alcohol used in the mixture is considerable?—Yes, it is.

5626. (*Dr. Thorpe.*) Would they be using as much as ten tons a day at Besançon?—I do not know.

5627. (*Chairman.*) It takes about 4 lb. of the mixture to produce 1 lb. of silk I understand; and roughly that works out to be about a gallon of proof spirit or a little more?—Yes, it would be about that.

Difficulties not connected with alcohol which contributed to abandonment of Coventry enterprise.

5628. (*Sir W. H. Holland.*) It would be useful if you felt free to mention some other hindrances that were felt in Coventry, in addition to the inability to get hold of duty-free alcohol. Do you feel at liberty to mention what other drawbacks you found, because then if they no longer exist, and if the barrier in the way of alcohol were removed, one could judge of the prospect of success?—I heard casually of something that ought not to have happened; I do not know how far it is true, but I heard that the sulphuric acid that we bought, and that was at the factory at the time it was given up, was very bad.

5629. I suppose you can get the best sulphuric acid in the world in this country?—Yes. That was no fault of mine; it was the fault of the chemist in not properly testing it, and seeing that it was sulphuric acid and not a mixture.

5630. So that is not an insuperable difficulty?—It is not.

5631. Can you mention any other difficulty that you had?—One great difficulty was because the manufacture of artificial silk was entirely new. There was no chemist in this country who had practically gone through the whole thing. Each chemist we had—and we had three—had to come and learn by experience.

5632. (*Dr. Thorpe.*) And also your managers in the same way?—Also the managers—they had to gain experience. We could not get them for love or money on the Continent; we offered to pay any wages to get them from Besançon, but we could not.

5633. In other words your difficulties were exactly the difficulties which every enterprise of this kind, on the Continent even, has had to go through?—Yes.

5634. And so practically the difference is that they on the Continent have hung on to the job rather longer than you were able to do?—I suppose so.

5635. (*Sir W. H. Holland.*) I think if you were starting again you would rather start with pure alcohol?—I would not attempt it without.

5636. (*Dr. Thorpe.*) The real point is this, that whereas the other concerns at Besançon and Jülich, and all the other concerns that we have heard of, have had very considerable difficulties, practical and other, you have had all those similar difficulties, but you have not worked at it so long as they have done, and apparently you have not had sufficient capital at your back to continue making those experiments; is not that the real fact?—You have hit the nail on the head there. When we reconstructed the company we did not ask for enough money. This new enterprise took a good deal more money than we ever anticipated. Men who professed to be experts gave their opinions, and it was put on the prospectus, and we were deluded by the initial cost of the works for one thing—the initial cost of the machinery and the amount that it would take to carry on the business.

5637. To get it into working order, you mean?—Yes.

5638. (*Mr. Scott Montagu.*) The chemist practically had to learn at your expense; that is what it comes to?—Yes.

5639. Therefore it was an expensive lesson and you had to pay the fees?—That was not very much—two or three hundred a year.

5640. (*Mr. Tyrer.*) Then there was the cost of the experiments?—It was costly in that way.

5641. (*Mr. Scott-Montagu.*) Your chemists were learning their work at the expense of the company, but if they had known their work thoroughly from the beginning the experiments would probably have been sucessful. As it was they made mistakes which were inevitable because they did not know the process?—We should have achieved success much sooner—I do not say that we should have achieved success at once—if we had had a chemist who had been at it for two or three years and who knew the business—because it is so tricky.

5642. (*Dr. Thorpe.*) Not only your chemist, but everybody connected with the actual working, was in the same position—they all had to be educated, down to the smallest operative, had they not?—That is so. I had to learn it myself.

Prospects of re-starting the industry in this country under provisions of Finance Act, 1902.

5643. (*Mr. Tyrer.*) The people who had to do with this experiment are not all dead yet, are they?—One poor fellow is.

5644. I should like to ask you whether you think there is experience enough in this country of this manufacture to give promise of reasonable success, should another enterprise be started here?—I do not think so.

5645. (*Mr. Nicholson.*) Having in view that the Act of 1902 empowers the Board of Inland Revenue to grant free alcohol, do you still think that it would not be desirable to start another company?—I should not like to give an opinion about it.

5646. Would you like to go in for it yourself—I will put it that way?—If I did nothing else and gave it my personal attention I should not mind.

5647. Your point of view has been altered by the Act of 1902?—Yes, it has to a certain extent.

Mr. J. Cash
8 Feb., 1905.

5648. To the extent of possibly inducing you to go in for it a second time ?—Yes.

5649. (*Sir W. H. Holland.*) Then also in the interval, very much more experience has been gained on the Continent, and you can buy that experience ?—Yes. There was one chemist we had who really was very dissatisfied with everything. If he had had all the alterations he wanted, I do not know whether he would have been successful—we did not know, and he did not know. He was a man who knew all about nitro-cellulose and he was a very good man indeed, but he wanted so many alterations that we really thought we were never going to get to an end.

5650. What capital was there employed in this concern, do you remember ?—It was £60,000, but of course, as you know with companies, there was not all that went into it.

5651. (*Mr. Scott Montagu.*) How much absolute cash was put in ?—I forget the amount of cash that went into the works.

5652. How much money was absolutely wasted ?—I think about £40,000 was spent in the works, and on experiments in producing this silk.

5653. (*Mr. Tyrer.*) What have they spent at Besançon ?—I do not know, but they have spent enormous sums.

See Q. 5490.

5654. (*Sir William Crookes.*) About the effect of the impurities in the methyl-alcohol. I think you said something about the silk not wetting ?—It was wet, and you want to get it as dry as possible after it comes through the silkworm.

5655. I misunderstood the word; I thought it was of a greasy character, and you could not wet it afterwards ?—It was sticky and wet; that was the great fault. That could not possibly be from the machinery.

REPORT HANDED IN BY MR. J. CASH.

REPORT OF DIRECTORS AND GENERAL MANAGER OF THE NEW ARTIFICIAL SILK COMPANY, LIMITED, WOLSTON, SUBMITTED TO EXTRAORDINARY GENERAL MEETING, HELD AT WINCHESTER HOUSE, OLD BROAD STREET, LONDON, E.C., ON MAY 31ST, 1900.

JOHN ADAM SCOTT, *Esq.* (*Chairman of the Company*), *presiding.*

The Chairman: Ladies and gentlemen, seven months have now passed since we last met, and since then some changes have taken place in this company, and many difficulties have cropped up, some of which have been overcome, while others, I am sorry to say, like the poor, are still with us. Mr. Cash, your late chairman, has ceased to be a member of the board, and I was unanimously elected to fill his place by my co-directors. This position I did not seek and I do not covet now, but having been early connected with this enterprise I was resolved on behalf of the company to do all I possibly could to bring it to a successful issue. But, gentlemen, I had made up my mind before I could take the position of chairman—and I am glad to say all my co-directors agreed with me—that a circular should be sent asking you to this meeting, so that you might hear exactly what we had been doing, and what our position is to-day. I thought this the first thing that should be done, as you have a right to know all about your property, whether the company is successful or not. As you are aware, some months ago Mr. Westermann, then the managing director of the Swiss works, was elected a member of our Board. I had, and have still, great confidence in that gentleman, as with his intimate knowledge of the manufacture of artificial silk in Switzerland, I looked to him to set us right in many technical points which only his experience could direct aright. Let me say he has helped us very materially in many instances, but as he is here I will allow him to speak for himself. When Mr. Cash ceased to be a member of the board, on the 18th April last, Mr. Rodakowski was made general manager. He was early interested in the Swiss Artificial Silk Company, and being a large shareholder in our concern we felt we had in him a competent man who not only could give us substantial help, but who was willing to devote most of his time in the interests of your company. This he has done to our satisfaction, and no one who knows the energy and anxiety he has shown can for a moment doubt that his whole heart and soul are in his work. We have thought it best that he should give you from his own lips his report of what we have done and what we are doing, and although it may not be as promising as I could have wished, yet it is a clear and unvarnished statement of facts which you, gentlemen, ought to know. Before calling upon Mr. Rodakowski I should like to say on behalf of every director as well as myself, that we place ourselves unreservedly in your hands. If with the new arrangement you have confidence in us, we are willing to stick to the ship, and try and bring it to port. I have been connected with business all my life, but I must honestly confess I have never had anything to do with such an intricate and puzzling business as this one is. One week we find matters going fairly well, while the next week grave difficulties crop up which we cannot get rid of. Where the exact defects are it absolutely passes my comprehension to find out. But, gentlemen, your works are in splendid order, and everything connected with them is A1; but this only intensifies my mortification when I find that we have not yet reached a paying stage. What we have to suggest to you is that a small but practical committee, selected from the shareholders, be appointed to confer with the board. If you agree to this, these gentlemen can go into all the workings, and see all that we have done, and then make an independent report to you as to the best course to pursue in the future. Gentlemen, without saying anything further, I should like you to hear Mr. Rodakowski's report, and I will now call upon that gentleman to address you.

Mr. RODAKOWSKI: Gentlemen,—Before reporting to you on what has been done at the mills since my appointment, I think it desirable to refer briefly to the state in which the manufactory was at that time.

In October, 1899, I believe, the opinion had gained ground amongst the directors and officials that the main thing barring our way to success, was the impossibility of closely following the precepts of Besançon by using pure alcohol in connection with ether for the solution of nitro-cotton. The laws of this country would not allow us the duty free use of pure alcohol without methylation, and steps were then taken to secure this permission from the Government.

Without going at great length into this question, suffice it to say that these steps were not successful. The principal chemist of the Government laboratories gave it as his opinion that the methylation of pure alcohol with pure methyl-alcohol or wood-naphtha could not be injurious to our process, and with the object of ascertaining the correctness of this contention, an experiment was undertaken at the end of March with alcohol methylated on our premises. The first experiment was considered unsatisfactory and inconclusive, owing to the limited amount of alcohol at our disposal free of duty (I believe 300 gallons).

On April 9th, Messrs. Scott, Nye & Westermann went to the principal Government chemist, discussed the matter with him and obtained a new permit for 500 gallons, to which gradually additional permits for a total of 1,250 gallons were added.

As an outcome of the discussion with the Government chemist, steps were taken to secure the purest wood-naphtha procurable in the trade. My appointment coincided with the preparations for the experiment, which at that time was considered to be the final one, the directors understanding that, should it not be successful, the Government would then grant us permission to use pure alcohol duty free for our manufacture.

Since then further interviews with the Government officials have convinced us that there is but very little hope of our getting this permission within a reasonable time, even should we succeed in proving that the use of pure alcohol is indispensable.

The experiment was commenced on April 23rd, with cotton declared to be very good, the purest procurable wood-naphtha for methylation, and acid of a specially approved formula. We were at once confronted with the difficulty that the nitro-cotton would not give the proper test results. The chemist hoped, however, to correct this as he went on, experience having shown that the acid did not readily yield to any alteration in the proportions of its composition. The collodion we produced was clear and throughly satisfactory, and it started to spin extremely well, which result was especially gratifying, as all experts agreed that even the best collodion required to run for some time through the pipe system before spinning well. For this reason also, no weight was attached to the fact that a certain number of the bobbins spun were too wet and sticky and in consequence difficult to wind. The manager and chemist, justified by previous experience, expected that this would get better as we went on; instead of doing so, however, it grew worse. Various suggestions were made for the remedy of this difficulty, and many explanations were offered by the experts. As all these, however, were guesses and not certainties, we decided without stopping the spinning to look for the explanation successively in every part of the manufacturing process.

The cotton, the first consignment of which had appeared so excellent, had fallen off in quality. Steps were, therefore, taken to obtain cotton identically alike to the one used at Spreitenbach. The composition of the acid was gradually altered, the consistency of the collodion also gradually increased. All this had to be done by degrees, to avoid any interruption of the work. On finding that the spinning was especially wet in the morning, growing much drier in the afternoon, we concluded that the cessation of work by night was disadvantageous, and, therefore, decided to make an experiment with night work. Such an experiment, however, is not easily carried out. Skilled labour for night work has to be procured. This takes time, and we have not yet been able to train sufficiciently the men who were at once engaged to be taught the spinning.

I will not weary you with an account of all the attempts and efforts that have been made to get rid of the wetness of the bobbins. Suffice it to name a few.

The Centrifugal Wizzing Room has been heated, the fans blowing air through underground air ducts into the factory have been stopped and reversed, when it was ascertained that the air they brought in was saturated with moisture owing to the wetness of these air ducts.

These are experiments you will say, and so they are, and it would be misleading you to induce you to believe that we at Wolston have got over the technical difficulties of our manufactory. But after mentioning the intricacies of the manufacturing process all the difficulties are by no means exhausted.

At the present moment we are spinning successfully a large number of bobbins per day, of which, however, a large proportion are certainly wet and useless. Supposing that all was working well, we could, with our plant, turn out above 218 lbs. of silk per day. But even now our production could be greater, for only two of our eight spinning machines are working, producing, exclusive of waste, about 19 lbs of good finished silk per day. We could, therefore, at present turn out about 76 lbs. per day, notwithstanding the large proportion of wet bobbins, if we had a sufficient reserve of silk worms, sufficiently skilled workmen, and a larger number of acid mixing pots.

Silk worms we call small glass tubes affixed to the collodion pipes through which the collodion is squirted, and thereby converted into silk threads.

When a new spinning machine is set going, the collodion does not squirt well, it stops up the capillaries of these glass tubes, necessitating a constant change of tubes for the purpose of cleaning them. This cleaning process occupies between 24 and 48 hours, and in the meanwhile we are dependent on the reserve stock. Besançon, I understand, has several hundred thousand silk worms in reserve; Spreitenbach, 120,000, and we have to-day only 21,000. We do not, therefore, start any of the other spinning machines, as we should risk running short of silk worms, and thereby being stopped altogether.

I need not assure you that everything is being done to remedy this want, but unfortunately these silk worms are a speciality of our manufacture, and cannot therefore be readily obtained on the market at short notice. We ourselves turn them out at the rate of a thousand a day on our own premises, but these only just suffice at present to keep us going.

The Labour Question is not a less difficult one. The village of Wolston only offers accommodation for a very limited number of workmen. The surrounding villages are few and far between, and it is therefore difficult to obtain labour. Steps have been taken to start a special workmen's train from Coventry to Wolston and back, and by these means we hope to make it easier for us to get workmen. But the arrangements with the railway company are not yet completed, as they ask us for a guarantee, which in view of the present state of our manufactory we do not feel justified in giving.

The Cotton Supply is another difficulty. We require a special quality of bleached cotton waste for our manufacture; a requirement which I believe no other manufacture shares with ourselves. The consequence is that this article also is not easily obtained. On the British market we have experienced great difficulty in getting a regular supply of an *even* quality. The sample lots are sometimes good, but the bulk shows a tendency to deteriorate in quality. No doubt in time we shall be able to train the market to our requirements, but at the present we have been forced to apply to Swiss firms, who regularly supply Spreitenbach, and therefore know the requirements. From them we are getting about 4,500 lbs. which delivered at Wolston will only come to about 6½d. per lb. (against 6¼d. to 7½d. of British cotton waste).

Now as to the demand for our article, you have been frequently told that it has been enormous. That may have been so, but at present this is not the case. Various reasons may have brought about this present slackness of the market—chief amongst them, the want of a continuous supply.

Since the reconstruction of our company, we have sold 11 pounds of silk as samples. We now have about 1,400 pounds of artificial silk in stock, and having been unable to sell the material ourselves at satisfactory prices, we are at present in correspondence with agents for the purpose of pushing the article.

The cost of production. The cost of production is naturally a large one. The directors do not consider it desirable that I should give you an accurate figure, but I may say that it is considerably larger than had hitherto been supposed, and allows of no profit at the present sale price.

This long enumeration of all the difficulties and disadvantages we have still to contend with may be gloomy, but you have had, gentlemen, since engaging on this venture, a sufficient amount of hopes and expectations held before you, so I think it will be better to face the plain bald facts, and see if and how we can grapple with these difficulties. With your permission I will take them one by one.

The difficulties of manufacturing. Whether we will be able to overcome this difficulty during the limited time which is still left to us, I do not profess to know. The manufacture is an *extremely intricate* one. You have in previous years had the advice of Count Chardonnet, the inventor of this process. You have since October had the advice of Mr. Westermann, the manager of Spreitenbach (where they are manufacturing a large amount of silk), and notwithstanding that this latter gentleman's advice has

Mr. J. Cash.
8 Feb. 1905.

been followed out scrupulously, we have hitherto been unable to overcome all the difficulties. Your Manager, Mr. Moss, as regards the technicalities of the work is very competent. Your chemist, Dr. Lorentzen is scientifically a highly trained man of the very greatest ability; so that I think you may rest assured that if the difficulties can be solved—they will be solved.

The difficulties as regards Silk Worms, Skilled labour, acid pots and *cotton supply* will undoubtedly be overcome in a very few months. *The demand* for our article may be improved by a regular supply and by the judicious pushing of it when patterns are being made up, at the proper season of the year. But this I fear will take a considerable time, certainly a longer time than our present capital will last.

If after all you have heard you come to the conclusion that at the present moment we are no better off than we were before the reconstruction, I will venture to disagree with you.

We are producing regularly good artificial silk, although with a large percentage of waste, and we have now come to the conclusion that it is not so much bad machinery and defectives pipes which prevented us from doing better, but our lack of experience and knowledge of the intricacies of this process.

Besançon has gone through that stage, and Spreitenbach has gone through it, and both of them have emerged from it. I do not say that we could not have emerged from it sooner, but now that you have spent 22s. 6d. per share in laying foundations, though cemented by failures, trials and mistakes—are you going to let this undertaking go to the wall in the eleventh hour—and let others reap a future benefit—others who I feel sure are only waiting for this moment? In a future and ultimate benefit I do firmly believe. Artificial silk is still in its infancy, the Besançon infant is a bit further progressed than we are, but nobody has yet realized or measured the scope of this article. So far it has alternated between a boom and a slump. The consumers have seen its possibilities and have eagerly pressed for supply. Then the slump supervened in consequence of the disappointment of the consumers through either insufficient supply or extortionate prices demanded by agents. When once the market sees that a steady and sufficient supply of this article is assured its use will be a hundredfold increased and handsome profits will be realized, not by large margins on the individual "lb." of silk, but by the extent of the production, and those profits, gentlemen, as all of you know, are the only sound and lasting ones.

Before closing, I beg to be allowed to make a short statement of our financial position. Our expenses are about £1,200 per month. Our liabilities are about £811. Our bank balance, with calls in arrears, represents about £4,479.

The CHAIRMAN: You have heard Mr. Rodakowski's Report, and I will now ask Mr. Westermann to say a few words to you. He was, until lately, the managing director of the Swiss works, and he has had great experience in the manufacture of artificial silk in Switzerland.

Mr. WESTERMANN: Mr. Chairman, ladies and gentlemen, I can completely concur in what has been said in the report of the general manager. I have found it very puzzling that the formula which would work so well in Spreitenbach would not work over in this factory. I could not give it all the time which was necessary, in consequence of my being manager of the Swiss works. I can give it now a little more time, because I have left the Spreitenbach works, and I hope that the difficulties which we have still to overcome I shall be able to help to overcome. Ladies and gentlemen, if you have any questions to ask I am sure we will be delighted to answer them to the best of our ability.

A number of questions having been asked and answered by the Chairman, Directors and Officials present, the following Resolution having been proposed and seconded, was carried unanimously:—

> "That a Committee of five Shareholders be appointed to confer with the Board; that three members of such Committee present at any meeting shall form a quorum.
>
> "Such Committee to consist of Messrs. M. OLDROYD, W. S. COLES, J. S. STEWART WALLACE, E. J. SMITH and C. T. QUESTAL, with power to employ outside help, to fill any vacancy, or add to their number."

SEVENTEENTH DAY.

Friday, 17th February, 1905.

PRESENT.

Sir HENRY PRIMROSE, K.C.B., C.S.I., I.S.O. (*in the Chair.*)

Prof. Sir WILLIAM CROOKES, F.R.S.
Sir W. H. HOLLAND, M.P.
The Hon. J. SCOTT MONTAGU, M.P.
Mr. LOTHIAN D. NICHOLSON.
Dr. W. SOMERVILLE.
Dr. T. E. THORPE, C.B., F.R.S.
Mr. THOMAS TYRER.

Mr. E. C. CUNNINGHAM (*Secretary*).

Dr. JOSEPH HENRY HINCHCLIFF, called; and Examined.

Dr. J. H. Hinchcliff.

5656. (*Chairman.*) I believe you hold an appointment under the Department of Agriculture and Technical Instruction for Ireland?—Yes.

5657. What is your position?—I am an agricultural inspector.

Manufacture of alcohol from Potatoes. The industry in Germany.

5658. I understand that you have recently, on behalf of the Department of Agriculture and Technical Instruction for Ireland, inquired into the system in Germany of the manufacture of alcohol from potatoes?—Yes.

5659. I suppose you visited Germany for that purpose?—Yes, I visited Bavaria, and also the alcohol exhibition in Vienna, last May.

5660. Did you not visit any of the eastern provinces of the German Empire?—No, I did not. I visited Bavaria owing to the reason that their distilleries are very often co-operative, and it was thought that if anything came of this industry in Ireland, probably the distilleries there would be co-operative, and therefore it might be as well for me to see the co-operative distilleries in Germany. That was my reason for going to Bavaria.

5661. Is the industry a large one in Bavaria?—Yes, it is fairly so. I have not the statistics with me, but in some districts within a few miles of Munich there is a distillery in every village.

5662. What is the quality of the soil there; is it pretty fertile?—Yes, it is fairly fertile in many parts.

5663. Taking the German Empire as a whole, this particular industry is, as a rule, confined to the less fertile parts is it not; for instance, you do not find much of it in the neighbourhood of the Rhine or even between the Rhine and Berlin?—No, you would not find it there perhaps so much, but it is fairly well established in the kingdom of Saxony, and there you have good land. It is of course more extensive still on the sandy lands in East Prussia and to the eastward of Berlin.

5664. The Committee have full informationbefore them as regards the Excise taxes, the Excise rebates, and so on, in Germany, and I do not think we need trouble you to go into the details of that very complicated part of the business. We would rather ask you certain questions as regards the general character and effect of the system and its possible applicability elsewhere. You have embodied the results of your inquiry in an article which appears in the Journal of the Department of Agriculture and Technical Instruction for Ireland, for January of this year, have you not?—Yes, that is so.

Weight recorder used for weighing the potatoes: but not for revenue purposes.

5665. In that article you describe the method of manufacture which we also know about. But there is one point in it that I should like to question you upon. At the top of page 310 of the Journal you say, "The unsorted potatoes, large and small, sound and bad, are first run through a washing apparatus, and afterwards conveyed to an automatic weight-recorder, before being delivered into the steamer." Is that automatic weight-recorder universal do you know?—I have visited three distilleries, and in each one there was such a weight-recorder.

5666. Is the record of the weight made in such a way that it cannot be altered until the Excise officer comes and inspects it?—The potatoes are weighed mainly in order that the people who send the potatoes may be paid according to their weight. It is a weight recorder very much like the weigh-bridges that are used for automatically weighing corn. It just tips itself up and cuts off the supply when you have got a certain amount, be it one ton or three tons, or whatever you are dealing with.

5667. That automatic weight recorder is not for the purposes of the Excise then?—No.

Quality of spirit produced at German agricultural distilleries. (*See* also Q. 5787-94).

5668. I may mention that Dr. Thorpe and I have recently visited one of these distilleries ourselves, so we have been able to compare our experience with yours. As regards the quality of the spirit when it leaves these agricultural distilleries, it is not in a very pure state, is it?—No, not at all.

5669. In order to fit it for use for potable purposes it would have to be rectified, would it not?—Yes; it goes into the rectifying factories afterwards.

5670. If it was going to be used for industrial purposes would it require rectification?—On that point I am not certain. My impression is that it is denatured and used as methylated spirit.

5671. Do the distilleries vary at all as regards the perfection of their manufacture; do some, that is, make a cruder spirit than others?—Do you mean as regards the yield from a certain quantity of potatoes, or as regards the percentage of alcohol in the spirit?

5672. I mean rather as regards the quality of the spirit, in so far as it contains impurities. Have some of these distilleries got better apparatus than the others have, and are they therefore able to produce a purer spirit less tainted with impurities?—I could not say.

Yield of spirit per cent. of potatoes used.

5673. As regards the yield of spirit from potatoes what is your calculation of the yield from, say, a ton of potatoes?—I have calculated it in my report. On page 311 of the Journal I say that one hundredweight of potatoes produces potato spirit equivalent to 1·43 gallons of absolute alcohol or 2½ proof gallons.

5674. That would be 28·6 gallons of absolute alcohol per ton, would it not?—Yes.

5675. In order to reduce that to proof gallons you must double it?—Almost.

5676. (*Dr. Thorpe.*) The diagram which you show on page 311 of your paper, illustrating the preparation of alcohol from potatoes, is given upon the authority of Professor Buecheler, I think?—Yes, that is so.

5677. Now, in reference to the particular potatoes referred to in that diagram, which I see are assumed to contain 20 per cent of starch, is the yield that you give the theoretical or the actual yield?—That is the actual yield obtained in factories.

5678. That is to say, the actual yield from a hundred weight of potatoes containing 20 per cent of starch is 2½ proof gallons of alcohol?—Yes, that is the actual yield; but that is only roughly two-thirds of the theoretical yield.

5679. When you speak of it as an actual yield, do you mean the average actual yield, because the amount must vary very much between distillery and distillery?—

Dr. J. H. Hinchcliff.
17 Feb. 1905.

That is what is obtained in the distilleries which I visited which are under the control of Professor Buecheler's department at Weihenstephan, near Munich. Several of them were getting from just over 60 up to 64 per cent. of the theoretical yield. This diagram is based on a yield of 63 per cent., if I remember the figures correctly.

5680. Is it taken from any published records, or was it furnished to you by Professor Buecheler himself?—That diagram in its entirety is taken from Professor Buecheler's book on the Distillation of Alcohol from Potatoes.

Potato spirit used for drinking as well as industrial purposes.

5681. (*Chairman.*) Just below that Table you deal with the utilisation of alcohol distilled from potatoes, which would seem to imply that it is not used for drinking purposes?—Later on I say, "When re-distilled and further purified, the alcohol obtained from potatoes is used as potable spirits and sold under various names." That perhaps should have been brought out more prominently; that, of course, is still the chief use of alcohol.

5682. That would be so, for I see that of all the spirit which is produced in Germany, something like four-fifths is produced from potatoes. Therefore, clearly, a good deal of the potato spirit must be drunk?—That is so. In the seasons 1897-8 to 1901-2 the average production per season was just over 381 million litres of alcohol, whilst during the period 1898 to 1903 the average yearly consumption of spirits was 238 million litres of alcohol.

5683. Do these co-operative distilleries purchase potatoes from the adjoining farmers?—Yes, that is so.

Potatoes for distillation. Price, (*See* also Q. 5715-6).

5684. What sort of price do they pay, do you know?—That varies to a great extent, somewhat according to season as with us, but also according to the district. I believe they are cheaper on the sandy soils to the east of Berlin, where there is not such a big demand. But last season, for instance, they were paying about 27 marks per metric ton, which is roughly 27s. per imperial ton. They considered that a high price, but potatoes were somewhat scarce, as there had not been such a heavy crop as usual.

5685. Could you say about what the normal price would be in an ordinary year?—Some of the agricultural Professors in their writings take 20s. per ton as the normal price, but in some districts they were telling me that 23s. per ton was usually what was paid.

5686. (*Mr. Scott-Montagu.*) What is the cheapest potatoes you heard of?—They were cheaper in Berlin. I have here a report from the Commercial Attaché at the Embassy in Berlin in which he gives figures showing that potatoes there are, at times, even cheaper than 20s. per ton for alcohol purposes.

5687. (*Mr. Nicholson.*) But not for consumption?—No, not for consumption.

5688. (*Dr. Thorpe.*) Did that have reference to some particular time; or, when he says that they are less than 20s. per ton, does he mean that the normal price is less than 20s. per ton?—He does not mean that.

5689. Then does he mean that they had touched on occasion so low a price?—Yes, that they had touched that low price.

5690. (*Dr. Somerville.*) The price you quoted just now, 20s. and 23s. per ton, was for potatoes that go into the distilleries?—Yes.

And quality.

5691. Does that price apply to potatoes which are being used for domestic purposes in the usual way?—No, the price of those potatoes is usually somewhat higher. The potatoes that go into the distilleries are a sort that are grown purposely for distillery purposes, and they are only suitable for distillery purposes. Owing to their high starch content, they are not very suitable for cooking.

5692. Is a high starch content objectionable in a cooking potato?—I was always told that these particular distillery potatoes would mash up when you were boiling them, and that you could not get them into a nice floury condition. I could not speak with experience on that point, but that is what I was always told when studying in Germany.

5693. (*Mr. Nicholson.*) Also, I suppose, diseased potatoes would be used for distillery purposes?—Yes, and damaged ones.

5694. That would naturally decrease the value of them?—Yes; of course they could not be sold for cooking or any other similar purpose. In that case the distillers would have the upper hand, and they would practically rule the price.

Selling price of potatoes in Ireland.

5695. (*Mr. Tyrer.*) Was the price of 23s. which you referred to a moment ago, the price in Ireland?—No, that was the price in Bavaria. That I was told was an average price in the district I visited. Last year, however, they were paying 27s. per ton.

5696. I have a letter from a correspondent who says that an Irish farmer would supply him—would be very glad indeed to do so—with any quantity of potatoes that he likes, under contract, for 25s. per ton; could you say from your experience whether that is possible?—It is not. I think if they were good potatoes, when prices are ruling in the north of England at from 42s. 6d. up to 50s. per ton, it would pay someone to get them across. I do not see that it could be done at that price.

5697. My informant was Mr. J. H. Leicester, M.Sc. of the Testing House of the Chamber of Commerce, Royal Exchange, Manchester. He was over in Ireland where he was in contact with a farmer who made the product that he was at that time testing, namely, wood pulp. Do you know Mr. Leicester?—I do not.

5698. (*Dr. Thorpe.*) Does your Department collect statistics as to the price of potatoes in Ireland?—The statistics we collect are not so much in regard to the price as in regard to the yield of potatoes. We do get some information regarding price from our various instructors in the counties.

5699. Is your Department in a position to supply information as to what potatoes are actually worth in Ireland, and what they are produced at, year after year? We could obtain that information, and for various districts, through our county itinerant instructors.

5700. (*Mr. Tyrer.*) Just as you could get the corn averages, I suppose?—Yes.

5701. (*Dr. Thorpe.*) That information, I think, would be valuable if you could furnish us with it. We know what potatoes must cost in order to produce alcohol from them economically, and if you tell us that potatoes can obtain much higher prices than the prices which can be paid for potatoes to be used for producing spirit, then of course that places the possibility of their being used for the production of alcohol rather out of the question?—This year prices have varied. In some districts in Ireland, unfortunately, we have not had much of a crop, but in many parts of the country potatoes are selling at from 35s. to 40s. per ton now, and in many parts just above 40s. It depends on the nearness of the town which is the centre of consumption.

5702. Is 40s. above the average?—We take from 35s. to 40s. per ton as the average.

5703. (*Mr. Nicholson.*) Is that the price on the farm?—Yes, or if not on the farm, at the nearest market where they can be delivered in the farmer's carts.

5704. (*Dr. Somerville.*) Is that price for picked potatoes, that is, with the diseased and blemished ones thrown out?—That is the price for potatoes for consumption, the diseased and blemished ones being thrown out.

Price of spirit in Germany regulated by a Syndicate (Centrale).

5705. (*Chairman.*) Did you obtain any informotion in Germany as to what sort of price these distilleries get for their potato spirit when they have made it?—No, I did not. There is one point regarding the price which I should like to mention here. Though I did not obtain exact figures about it, I was informed that the price to a great extent was regulated by the Syndicates; there is one Syndicate within another, and really it is so very complicated that I had not the time or the opportunity of going thoroughly into it.

5706. I understand that what they do is this. The Syndicate fix a price at the beginning of the "Campaign" which represents the minimum price; then at the end of the "Campaign," when all their operations for the year are over, if there is a surplus in the hands of the Syndicate, they distribute that money as an addition to the original price; so that the amount paid really varies from year to year?—That is so.

Spirit for motor purposes.

5707. (*Dr. Somerville.*) I see that in this report of yours you have called attention to the great increase that has taken place in spirit-driven motors ?—Yes, there has been a great increase.

5708. Did you ascertain whether motors that are driven by other agents had increased to a corresponding extent ?—I could not say about that.

5709. Although you say that spirit-driven motors have doubled in number in about a year, I suppose it is conceivable that petrol-driven motors have equally increased also ?—Quite so; that would apply to the petroleum motors or to any other motors.

Co-operative and proprietary distilleries.

5710. I suppose that potatoes used for distillation purposes in Germany are almost entirely manipulated in the so-called co-operative distilleries ?—No, not exactly. In Bavaria and the district I visited they were, but there are several proprietary distilleries where one farmer will have a distillery. I know parts of the Kingdom of Saxony where you will find a man farming a large farm who will have his own distillery.

5711. Do you think that a single farm in Germany would sometimes be able to keep a distillery going ?—Yes.

5712. I know some of the large estates have got distilleries, especially when you get into Bohemia and Austria ?—Yes, they have.

5713. I suppose that, as a general rule, it does take more than one farm, or even one estate, to keep a distillery going ?—It does in the districts I visited. I could not speak for Prussia, but in East Prussia the farms are large, and that is where potatoes are mainly grown, owing to the sandy nature of the soil. I think that one farmer would be able to grow sufficient potatoes there to run a distillery.

5714. In connection with the so-called co-operative distilleries, can you tell us whether they are co-operative in the strict sense of the word, that is to say, whether they divide their profits amongst those that run them ?—Yes; they do.

Price paid for potatoes (*See also* Q. 5684–90). Varies with amount of starch they contain.

5715. Are the potatoes paid for upon an analytical basis ?—They are paid for upon the percentage of starch. That is estimated not by a very exact method in some cases, but by means of the specific gravity and then by using Maercker's formula.

5716. So that if one person sent in potatoes containing 17 per cent. or 18 per cent. of starch, and another person sent in potatoes containing 20 per cent. of starch, the price to the two would be regulated accordingly ?—Yes. A certain standard is taken as the basis, and for every one per cent of starch made, you get a certain amount more per metric ton or per centner, or whatever they reckon by.

Other materials used.

5717. Did you find that any other agricultural product besides potatoes and barley was being used for the purposes of distillation ?—In one distillery I visited they were using a mixture of imported maize and potatoes; but those were the only products I met with.

5718. You have not heard of mangolds being used for the purpose ?—No. I was told by a man connected with a firm of machinery makers that they were constantly sending apparatus to France, where the distillation of sugar beet is a leading industry.

5719. Do you know whether or not sugar beet is so employed in Germany ?—I have no knowledge of that.

Variable prosperity of the industry in Germany.

5720. I suppose, notwithstanding the rather small prices per ton that you have brought before the Committee, the industry in Germany has on the whole been very prosperous, and has conferred great benefits upon the agricultural community of Germany ?—At times it has not been very prosperous. I was looking up a report this morning of a speech by Professor Delbruck, the President of the School of Distillery Industries in Berlin, and I saw that he spoke of the unsatisfactory condition of the distillery industry in Germany in 1901; so that evidently they have had bad times.

5721. He was talking of the depressed condition in 1901 ?—Yes.

5722. I suppose that the industry is not likely to be better now that the crops are very much smaller, which has been the case during the last two years ?—Not unless the price of potatoes rises. If the price of potato spirit is regulated by the syndicate so as to rise, then, of course, that would counterbalance the decrease in the crop yields.

5723. We have had some evidence to the effect that the price of spirit is very much higher; but, on the other hand, the price of potatoes is also a good deal up ?—So I would imagine; it was last year.

5724. No doubt where the profits were divided amongst the producers a smaller crop might in some cases be as profitable as a large one ?—Yes.

Yield per acre of potatoes for distillation.

5725. Do these varieties of potato which are specially suited to the production of spirit give very large yields ?—They were telling me in Bavaria in the districts I visited there, that they gave a somewhat larger yield than the sorts grown for consumption, that is for household purposes; but still they tell me that seven tons is considered a satisfactory yield.

5726. Of course, the estimated yield of the crops in Bavaria can be got out of some of their statistical books ?—Yes. My report refers more to the immediate districts surrounding the distilleries.

5727. Probably seven tons per statute acre is above the average ?—I would imagine that it would be, just as it is with us in Ireland.

5728. Are you aware that it is above the average of England ?—Yes.

5729. About six tons per statute acre is something like an average crop of potatoes in this country, is it not ?—Yes, and I think our statistics show somewhere about four tons per statute acre for Ireland; but we do not by any means consider it a good crop unless we can get seven tons.

5730. Do you think that in Bavaria and the other potato spirit producing countries they sometimes get up to twenty tons the acre—a figure that we have heard of in this country ?—I have had no experience of such crops.

5731. You have heard of them perhaps in this country ?—I have, but I have not heard of them in Germany.

Quality of potatoes for distillation. (*See also* Q. 5691-4).

5732. I suppose we may take it that the quality of the potato for distillery purposes has risen of late years ?—It has.

5733. They have been breeding potatoes in fact for these special purposes ?—Yes; those having a higher starch content have been chosen for planting.

5734. The duty is not imposed with the object of encouraging the production of a high class quality, is it ?—No, but rather with the idea of encouraging potato culture, generally.

5735. I think we are right in concluding that so far as you are aware the duty is not imposed in relation to the weight of the raw material that is dealt with in an agricultural distillery, but is only imposed with regard to the output of alcohol ?—The capacity of the mash tun, I think the technical term is, is also taxed, so that it is to their advantage to a certain extent to put in as concentrated a mash as possible, and hence to put in a sort of potato that has as high a starch content as possible.

5736. Now I think you say they have got up to about 22 per cent. of starch ?—At the Alcohol Exhibition in Vienna I saw several varieties of potato that had been tested at some of the experimental stations and found to contain over 22 per cent.

5737. Then not only, as you say, should the potatoes contain a high percentage of starch, but they ought to be of a character not to yield very much dextrine; is that not so ?—Yes.

5738. The relative quantities of maltose and dextrine should be as wide as possible ?—Yes.

5739. May we conclude then that not only the starch content, but also the character of the potatoes as regards the dextrine has been improving ?—Yes, that is so.

Potatoes could not compete with maize as a source of alcohol in this country.

5740. What is your opinion then, based as it is upon considerable experience both in Germany and in Ireland, as regards the possibilities of the potato crop, apart altogether from any Excise regulations, being utilised in this country for the production of spirit ?—I will give you one argument which to my mind at all events just

Dr. J. H. Hinchcliff.
17 Feb. 1905.

clears up the matter. We can buy maize I know generally for about £5 per ton, and I think if a farmer can get it at £5 or £5 5s. per ton, the people in a seaport town would be able to get it much cheaper if they bought it by many tons at a time—a boatload perhaps. Maize will contain, I suppose, on the lowest estimate at least three times as much starch as will potatoes, and you would therefore expect to get about three times the amount of alcohol from a given weight of maize, that you would expect to get from the same weight of potatoes; so that would only bring potatoes to about a third the price of maize.

5741. That is judging potatoes by the standard of maize?—Yes. I was speaking to Professor Wittelshöfer, the scientific adviser to the Federation of Spirit Distillers in Berlin. We were discussing this matter of prices. He told me he had visited England, and he said that he did not think there was any possibility in the British Islands of using potatoes as a source of alcohol, considering the prices at which grain could be bought—especially in the seaport towns.

5742. I suppose maize is a bit cheaper in this country than it is in Germany?—Yes; grain as a rule is a little cheaper.

Co-operative distilleries. Indirect advantage to farmer in addition to price of potatoes.

5743. You have spoken about 20s. and 23s. per ton as the price of potatoes for spirits in Germany; are we to understand that the farmer really gets nothing more in the shape of any sort of indirect concessions than this 20s. or 23s. per ton? It is conceivable, of course, that if that is the price at which the potatoes are valued in the distilleries, and distilleries are very prosperous, he may get a share of their profits?—He would get a certain amount, that is quite true; how much he would get I cannot say.

5744. Still you do not think the whole story is told when it is asserted that the price of potatoes is something like 20s. and 23s. per ton?—No.

5745. Do you think it is conceivable that there may be a considerable addition to those figures in the shape of rebates, or in the shape of "Zusatz" or something of that sort?—The prices quoted for the distilleries undoubtedly are somewhat low. Of course the people who send potatoes at that price will participate in the profits of the distillery, so that they will really get something more. The other prices which I quoted in the report which is printed in the Department's Journal, are, so to speak, absolute prices, that is, they are the prices as given on the open exchange in Berlin.

5746. For potatoes bought in the open market without regard to their origin?—Yes.

5747. (*Chairman.*) Is it not the case that over and above what a man gets for his potatoes when he makes them into alcohol there is, on the contingent of the distillery, a bonus of twenty marks per hectolitre from the *Verbrauchsabgabe*, so that that is a real subvention and a bounty upon the production of that quantity of spirit, is it not?—Yes, that is so; but of course that goes into the general concern, and when the books are made up at the end of the the year they decide then what profits they have made.

5748. I do not think that is so, as far as the distillery is concerned, because the distillery when it sells spirit up to the amount of its contingent, gets a debenture from the Government for the difference between the fifty marks and the seventy marks surely, and it is paid to them there and then?—Yes, but that does not go to the person who supplies the potatoes to the distillery; it goes, so to speak, to the distillery firm, be it co-operative or otherwise.

5749. But if the distillery firm is co-operative, a share of it does go back?—Yes.

5750. The people who supply the potatoes would get their share of that?—Certainly, with a share of the profits the distillery.

5751. (*Mr. Nicholson.*) That really enhances the value of the potatoes?—It does, indeed.

Potato distilling as an industry for Ireland. Estimate of price which could profitably be paid for potatoes.

5752. In your paper you say this:—"There arises the question—'Is this an industry which would be profitable in Ireland'? With a view to settling this question the following estimates, which apply to a distillery capable of dealing each season with 2,250 to 2,500 tons of potatoes, have been prepared. Such a distillery would require to be fitted with machinery and utensils for three daily mashes, each of 660 gallons, and would work eight or nine hours each day for 250 days, say, from the middle of September to the end of June each year. It is estimated that the yearly expenditure would be as follows:—

	£	£
(1) Interest and depreciation on (*a*) buildings costing	2,250	
and (*b*) machinery and apparatus costing	2,250	
	£4,500	
Interest at 5 per cent. on total outlay	225	
Depreciation 5 per cent. on machinery	113	
Depreciation 2½ per cent. on buildings	56	
		£394
(2) Cost of working—		
Wages of distiller for ten months	80	
Wages of four workmen at 12s. each per week for ten months	100	
Insurance "	55	
Up-keep of machinery	20	
Coals—eighteen cwt., daily at 18s. per ton	203	
		£458
(3) Cost of raw materials:—		
2,400 tons of potatoes not here reckoned		
Barley, nine bushels per day, at 25s. per quarter	352	
		£352
Total expenditure, including interest, but excluding cost of potatoes		£1,204

To meet this estimated expenditure, plus the cost of the potatoes, it is estimated that there would be available the following sums:—

	£
(1) Alcohol produced:—	
94,800 proof gallons at 10d. per gallon	3,950
(2) Value of the distillery refuse:—	
3,000 tons at 5s. per ton	750
Total receipts	£4,700
Less expenditure as above	1,204
Leaving as payment for 2,400 tons of potatoes, or, approximately, 29s. per ton	£3,496

Are the figures in this table German figures?—No, they are modified so far as it was within my power to meet conditions such as those which prevail in Ireland, I mean as regards wages, the number of workpeople, and so on.

5753. This table does not take into consideration, does it, the question of the Excise restrictions in this country?—No, it does not do that at all.

The estimate discussed, the conclusion being that the price that could be paid for potatoes is considerably overstated. (*See also* Q. 5844–9).

5754. You start with the cost of the buildings and the machinery as being £4,500?—Yes.

5755. That is entirely neglecting one of the Excise restrictions, which prevents brewing and distilling being carried on at the same time, and which would therefore necessitate a very much larger plant and a very much larger building than you contemplate?—Yes; it would have to be a distillery put up for that purpose solely.

5756. And it would have to work in the most economical manner possible, without regard to the Excise restrictions?—I am afraid I do not quite understand your point. Do you say that it would have to be a distillery as apart from a brewery?

5757. There are certain restrictions in this country which necessitate the operation of brewing for spirits being carried on at a different time to the operation of distilling?—Now I understand what you mean. Up to the stage when the mash is fermented by the yeast, that you regard as brewing; and afterwards when you distil that fermented mash it would be regarded as distilling.

5758. There are certain restrictions in this country which prevent those two operations being carried on at the same works at the same time; therefore the buildings and the plant must, on the most modest computation, be at least double the size, and a distiller would tell you that they are a great deal more than double the size; but you have not allowed for that in your calculations?—No, I have not.

5759. Nor for any of the other Excise restrictions?—No, I have not allowed for any expenses of control, or anything like that.

5760. To analyse to a slight extent your costs, I see that you charge coals at a quantity which works out at something a little over 5 lbs. per proof gallon of spirit produced; that is, as far as my experience as a distiller goes, quite abnormally low; is there any special cause to account for that?—I was taking the figures that were supplied to me by a firm of machinery builders for spirit distillers. So far as possible I checked them with the data which I obtained in the three distilleries I visited, and they are much in agreement.

5761. In a distillery in England, working with the very best coal obtainable—that is Welsh coal—the figures which have been reached have never approximated at all to the figures that you give?—That is the only information I can give upon that point, and as I say I was simply basing it on the figures given me by that firm.

5762. That is you got your figures from machinery makers, and not from actual experence?—Only from actual experience in so far as when I was in these distilleries I enquired what amount of coal they were using, and their figures seemed pretty much to tally, as far as I could make out. Hence I took the figures supplied to me by the machinery makers. I can quite understand that it was to their advantage to keep them pretty low.

5763. (*Dr. Somerville.*) It is not conceivable, I suppose, that these distilleries should also have been using large quantities of wood for fuel?—No, I do not think so; I certainly saw none about.

5764. (*Dr. Thorpe.*) I suppose that here you were rather trying to calculate the conditions of production in Ireland were you not?—I was trying to do that.

5765. Would you actually use coal in Ireland?—Yes, we would to a great extent.

5766. To the exclusion of peat?—They might use peat a little, but even in the co-operative creameries they use coal a good deal. Some of them use peat; it depends on the district, of course. On the whole you would have to use coal. I was out yesterday in the country in Ireland, and I came across a pumping station; they were using coal at that pumping station, although it was quite close to a bog.

(*See also* Q. 5795–5801).

5767. (*Mr. Nicholson.*) To follow on, I see you estimate barley at nine bushels per day, at 25s. per quarter; is that the cost of the barley itself before malting or after malting?—That is the cost of the barley itself; the cost of the malting is not reckoned in that.

5768. Surely that is a very considerable item to have to add?—I do not think it would be such a great item.

5769. I see you estimate for wet malt?—Yes, I do.

5770. Do you know that the cost of malting in this country, without the cost of drying, is something like 4s. per quarter?—No.

5771. That would be a very considerable addition to your 25s.?—Yes it would; but am I to understand that that is without drying—just moistening the grain, and spreading it out on the floor to malt?

5772. That is so. That would enhance the cost, would it not?—Yes, it would indeed; that certainly is an omission which I had not noticed. This, I may say, is done in Germany in the cellars underneath the distillery buildings, where they have a concrete floor in the basement.

5773. Then, again, as to the quantity of malt used to convert a ton of potatoes into spirit; is your information derived in the same way from the makers of the machines?—I think that has been checked with the amount stated in Professor Buecheler's book.

5774. It strikes an English distiller as being a very abnormally small quantity?—I could not say. I have no experience of distilling at all. I was investigating the question, of course, mainly from an agricultural point of view.

5775. The point of my question is, as you no doubt recognise, to show that these figures are not applicable to this country, having regard to the Excise restrictions more particularly?—Just so. So far as you have gone, you have been increasing the cost of production, and consequently decreasing the price you could pay for the potatoes, have you not?

5776. Certainly—which was what I had rather anticipated to find. So that altogether it is hardly too much to say that from a distilling point of view in this country, these figures could not be relied upon?—No, not definitely; that I quite grant you.

5777. Could you tell us how you have arrived at the first items in your Table, namely, the Buildings £2,250, and Machinery and Apparatus £2,250?—Some machinery-makers wrote to the Department of Agriculture in Dublin regarding this question, and they were asked to submit estimates of machinery and specifications. They sent up certain plans and from those plans one of the officials in the Department who deals with architectural work checked roughly the cost of the necessary buildings, and then, of course, we took directly the cost of the machinery which was given to us on their estimates. I have some estimates with me which I would be pleased either now or afterwards to submit to you.

5778. I am not in the least impugning your figures as applied to Germany; the point I want to establish with you is, that they are quite inconsistent with the possibility of establishing a distillery in this country?—I appreciate that.

5779. (*Mr. Tyrer.*) Was the estimate of £2,250 for the buildings ascertained on Dublin prices?—It was based on Irish prices—prices prevailing in the country.

5780. (*Mr. Nicholson.*) Those prices, of course, are not of much use, if the Excise authorities interpose and say, No, you must not use your plant in such a way?—I quite agree, that cuts at the root of the matter directly; but that is actually what they are put up for in Germany. I have a couple of estimates here, and those people would only be too pleased to do business on those terms. But if the Excise authorities step in as you say, and will not let you distil in the same buildings as those in which you brew, then that would, of course, increase the cost both as to buildings and as to machinery.

5781. I do not like to say they will not let you, but that the exigencies of the service require that precaution for the protection of the Revenue. Do you agree with that necessity?—Yes.

Manufacture of alcohol from potatoes could not be profitably carried on in Ireland, even without Excise restrictions (*See also* Q. 5802–3.)

5782. (*Sir W. H. Holland.*) I should like to ask if any progress has been made with this industry in Ireland. I see that the figures in your paper are estimated figures; have you any practical figures based on actual experience?—No; potatoes are not distilled in Ireland.

5783. Even these estimated figures do not show the trade to be very profitable, do they?—They do not, and from what I have heard already it would seem to be even less profitable than those figures would appear to show.

5784. If it be so very unprofitable, you would not say that it would be a very suitable industry for Ireland; indeed I should think that a very unprofitable industry would not be a suitable one for any country?—I agree. But I was only looking at it in the opening remarks of my report from the point of view of economics. Later on, after giving those figures, I say that it would not do for Ireland.

5785. It would be a very good thing for Ireland, of course, if money could be made out of potatoes in that country in this way?—Yes, it would, if we could only get a satisfactory price for the potatoes. But as I say in my report, "It is not possible, in view of the above figures, to manufacture alcohol profitably from potatoes in Ireland, since higher prices than 29s. per ton are always realised by farmers for potatoes for other purposes."

5786. However liberally you were treated by the Excise authorities, would you still be of the opinion that it would not be possible?—On those figures.

Strength and quality of spirit produced at German Agricultaral Distilleries. (*See* also Q. 5668–72 and 5681–2.)

5787. (*Mr. Nicholson.*) For industrial purposes I believe a very high strength of spirit is required in Germany is it not?—I could not say. I do not know how the alcohol is treated after it leaves the distilleries.

5788. (*Dr. Thorpe.*) Do you know at what strength it does leave the distilleries?—At a strength of from 92 per cent. upwards; some of it up to 96 per cent. I was told.

Dr. J. H. Hinchcliff.

17 Feb., 1905.

5789. Cannot that be immediately applied to industrial purposes without any further treatment ?—I do not know.

5790. Do you know that it actually is methylated as it is, that is, that it is directly denatured as it is, without any other treatment than the denaturing ?—I know that; but that is not done in the distillery.

5791. As it is distilled, could it be taken and denatured ? —Yes.

5792. In other words, could it be put to an industrial application as it stands ?—Yes.

5793. (*Mr. Nicholson.*) As it comes direct from the agricultural distillery ?—Yes.

5794. (*Mr. Tyrer.*) Although the quality is not sufficiently good to make it fit for potable purposes ?—That is so.

Price of barley. (*See ante* Q. 5767-72.)

5795. (*Mr. Scott Montagu.*) When Mr. Nicholson was criticising your figures, it struck me that the 25s. per quarter at which you reckon your barley was rather too high; what do you say to that ?—It is not, of course, malting barley; it is a cheaper barley than the usual malting barley.

5796. I would not venture to dispute your statistics with reference to Ireland, but in this country barley can be bought very often well under 25s. per quarter. —I had partly in view the prices prevailing in the North of England.

5797. (*Dr. Somerville.*) You can buy so-called grinding barley at 20s. per quarter, but as a matter of fact the ordinary price for decent brewing barley just now is 28s. and 29s. per quarter, and if you obtain the very best that you can get out of Cambridge and Norfolk you will have to pay very nearly 40s. ?—I will take those figures from you.

5798. (*Mr. Scott Montagu.*) For your purpose of making alcohol, barley which is slightly discoloured and barley which is musty will be equally good, and therefore, as in the case of the potatoes, you can get your barley very much under the market price ?—Yes. The prices that have just been quoted refer, of course, to England. I recently had occasion to compare the prices ruling in the North of England for malting barley with those ruling in parts of Ireland. I was told that I could buy malting barley for 25s. or 26s. per quarter in Yorkshire at the present time; whereas in County Carlow, one day this week, I was informed that prices ranged up to 30s. If malting barley is dearer in Ireland the other barley is dearer too.

5799. (*Mr. Nicholson.*) Barley, as you know, is not used for the purpose of actually making the alcohol, but for the purpose of converting the starch ?—Yes.

5800. So that it would not matter if it were discoloured ?—No, it would not, provided the barley would still germinate, or grow.

5801. (*Dr. Somerville.*) That is a necessary condition, is it not ?—Yes.

Excise restrictions on distilling (*See ante* Q. 5755-9).

5802. (*Mr. Scott Montagu.*) I suppose that in preparing these figures, you anticipated that the Revenue restrictions would be at any rate, to a certain extent, modified ?—I have not studied the Revenue particulars very closely, as you doubtless by this time are aware; but that is taken for granted in these figures, as has already been shown by questions which have been put to me by previous members of the Committee.

5803. If any modification of those restrictions were found to be possible, your figures might still hold good to a certain extent ?—They would to a certain extent, but evidently they do not tally with the experience of distillers distilling in the United Kingdom—from what I have heard in this room.

Possible advantage to Ireland of using diseased potatoes for distilling. (*See* also Q. 5693-4 and 5825-32.)

5804. Has it ever occurred to you that the advantage to Ireland of a potato distillery would lie chiefly in the years in which the potatoes were so very bad that it would not pay to export them ?—Certainly; in fact that was one of the things which brought this question into prominence in Ireland.

5805. Possibly, if you had a year of potato disease, or great difficulty in getting them up on account of the wet weather, it would be a very great benefit to the agriculturists of Ireland if you had some system of distillation ?—It would.

Beet as a source of alcohol. Its cultivation in Ireland.

5806. (*Mr. Tyrer.*) Did I hear you speak about the production of alcohol from beet ?—Yes. I am given to understand that instead of using potatoes in France they to a large extent use beetroot pulp.

5807. What is the yield ?—I do not know. I have no particulars regarding the use of beetroot.

5808. I suppose, with the usual allowance for waste and other conditions, the yield would be pretty much the same for the saccharine material ?—If you mean the theoretical yield, I suppose it would be so.

5809. Has the cultivation of beet been attempted in Ireland ?—It has, but on an experimental scale only. Some few plots have been grown.

5810. Was the experiment an encouraging one ?—To a certain extent it was. Some of the beet had only 8 per cent. of sugar, but a good deal of it had above 15 per cent., which is of course very good.

5811. Fifteen per cent. is supposed to be the minimum for good work, is it not ?—In many districts in Germany the average is 15 to 17 per cent.

5812. Is the soil of Ireland suitable really for growing beetroot ?—Not as a whole. It is not deep enough. At least the cultivation that has been carried out up to the present has not been deep enough on the whole for beetroot. You have to plough somewhat deeper than usual, and then to sub-soil. In some districts, where we have a great depth of alluvial soil, beetroot may profitably be cultivated; but that is only within very restricted areas.

5813. (*Mr. Nicholson.*) Even in Germany very little beetroot is used for making spirit, in spite of its higher sugar percentage, I understand ?—I have no statistics regarding that point; but I have a report from the Embassy in Paris regarding the use of sugar beet in France.

5814. Does your knowledge bear out what I suggest, that very little beetroot is used in Germany for alcohol making ?—You are quite right; in Germany very little is used for that purpose.

5815. And that in spite of its high sugar percentage ?— Yes, in spite of that.

5816 (*Mr Tyrer.*) And even in Ireland the prospect of its successful cultivation is variable with the districts ? —The Department are at present engaged in collecting information relative to the cultivation of sugar beet, and although the inquiries are not completed, it is not thought that as a rule it would be profitable over the country. It may be in certain districts, but that will be all.

Potato cultivation in Ireland.

5817. Does the same remark as to the variation in suitability of the soil, and therefore in the production of the tuber, apply as regards potatoes in Ireland ?—I do not think it does to the same extent.

5818. But one district does differ from another in regard to potato production ?—Certainly.

5819. Would you say very widely ?—Yes. On the hillsides in Connaught there is far less weight of potatoes grown to the acre than on good land, say County Down, or in County Tyrone in the district between Strabane and Londonderry.

5820. Have experiments been made with crops of a considerable range of variety of potato, as in Germany ? The cause of my question is, that the statement has been made that there are some 200 or 300 varieties of potato grown in Germany, and that there they have gone on enterprisingly selecting the best and the most suitable of the different kinds for the different districts. Has that been tried in Ireland too ?—Variety tests are carried out each year, and of course those have reference to locality, but they have not reference to the starch content. So far as I am aware, the starch content has not been estimated.

5821. Do you happen to know whether the starch content rises with the better class of potato ?—From what point of view do you mean that it is a better class of potato ?

5822. From the point of view of the available starch for distillation purposes; assuming that the potato could be produced economically, then there should be, as a matter of enterprise, a cultivation of the best potato, containing the largest amount of available starch ?—Yes, just as is done in Germany at the present time.

5823. Have the Irish people—I mean the Irish farmers as a whole, or even any section of them, apart from your Department—shown any disposition to be enterprising and receptive in the matter of new ideas ?—Certainly. This question of the production of potato spirit was taken up by the agricultural press, and by farmers in general; and our instructors in the various counties had many inquiries regarding it, as they are having at the present time regarding the sugar beet question.

5824. So that it is somewhat of a libel to say that the Irish farmer does not want anything, except to be let alone ?—And a very serious one too.

Utilization of diseased potatoes for distillation (*See also Q.* 5693-4, 5804-5 5837-41.)

5825. (*Sir William Crookes.*) One question about diseased potatoes; you say all were run in, good and bad ?—Yes.

5826. There is much less starch in diseased potatoes than there is in good potatoes, is there not ?—Yes.

5827. What would be the quantity less ?—I could not say to what extent decomposition would have changed the starch.

5828. In a bad year, when there was a considerable quantity of disease about, the percentage of starch would therefore be very much diminished ?—It would, to a great extent.

5829. Therefore, although the price would be very low, the yield would also be very low ?—Yes, much lower than with healthy potatoes.

5830. Is there potato disease in some parts of Ireland every year, or does it appear only occasionally ?—It exists in some parts of Ireland every year, but it is much worse in some years than in others.

5831. If you had plant for making alcohol from potatoes, and you could only employ it remuneratively by using diseased potatoes, then if there were always diseased potatoes to be got, you could use your plant all the year round; but if there is only now and then a year in which you could get diseased potatoes, then your plant would have to be lying idle for some years ?—Yes. Of course there is another way of using diseased potatoes, and that is by cooking them and feeding them to pigs, which is the usual method. For that purpose they have a decided value.

5832. You say you do not know what amount of starch would be contained in a diseased potato; it would of course depend upon the extent of the disease ?—Yes, I suppose it would.

Possibility of increasing production of potatoes in Ireland.

5833. (*Chairman.*) Assuming that there was a large market for potatoes, would it be possible to produce very much larger quantities in Ireland than are produced now; is there much land which is now waste, on which you could grow potatoes ?—Of course reclamation is going on, and potatoes are taken as a usual farm crop after the land is reclaimed; but there is also a great deal of land which is now used as pasture, which could be ploughed up and utilised for the production of potatoes.

5834. Is not the pasture valuable ?—Certain authorities are arguing at present that the grass land in some districts should be ploughed up, as it would give better returns under cultivation, and potatoes would be one of the crops grown.

5835. Do you think that under certain circumstances it might be profitable to convert land which is now used for grazing and for dairy purposes into arable land ?—Yes.

5836. I suppose the best dairy lands are much more profitable in that form than any other, are they not ?—Some of the best grass lands undoubtedly are more profitable as grazing lands.

Diseased Potatoes. (*See ante* Q. 5825-32.)

5837. (*Dr. Somerville.*) No doubt in the West of Ireland potato disease is commoner than it is here; but, on the other hand, is it not the case that in the West of Ireland you are applying much more systematical methods to the prevention of disease ?—Yes, that is so. Furthermore, the potatoes there are only grown in small tracts, and you may get some plots here and some plots there, and then an interval of a few miles of mountain or bog land before you come to any other plots; so that it would be extremely difficult to gather together, even in a bad year, a sufficiency of bad potatoes to run a distillery, I would imagine.

5838. Potato disease displays itself with great suddenness as a rule, does it not ?—It does.

5839. There would not be very much time to get the Excise machinery put in order, and to get the various necessities of a distillery together, when the disease had declared itself ?—No, of course not.

5840. Furthermore, I suppose when potatoes are badly diseased they do not last many weeks ?—No.

5841. And consequently the utilisation of diseased potatoes for the purpose of distilling would be confined to very few weeks—at the most to a month or two in the autumn ?—Yes.

5842. Do the distilleries in Germany as a matter of fact use potatoes right through the winter ?—They do right away through until June.

5843. Then I take it that the potatoes in Germany are not stored as they are in this country, in pits outside ?—Many of the distilleries have them stored in a building devoted to that purpose.

Prospective profits of potato distillation in Ireland are too small to induce Irish farmers to grow potatoes for the purpose.

5844. (*Dr. Thorpe.*) Do you know whether within your Department the facts that you have brought together, and the conclusions you have arrived at, have practically settled the question as regards the economical production of alcohol from potatoes in Ireland ?—So far as I am aware, that is the case. I have not seen Sir Horace Plunkett to speak to him about this, but I have received no further instructions since I sent in this report. As has been shown by previous questions this estimate of mine takes the most lenient view of the restrictions.

5845. (*Mr. Nicholson.*) Or rather it takes no view at all of the restrictions ?—That is so.

5846. (*Chairman.*) It leaves them out of account altogether ?—Yes; so that it is taking the best view of the case, in fact.

5847. (*Mr. Nicholson.*) Does it not amount to this; that the Committee must disregard your table, as being inaccurate ?—Yes. You might disregard it, too, simply from the point of veiw that you could not afford to pay even 29s. per ton.

5848. Your conclusion is that 29s. per ton is much too high, is it not ?—It is too high. If the farmers in other directions can get more than 29s. per ton, or if the Table were so modified that the price was brought down to 25s., or it may be 20s., then of course the Department could not take any steps, because the farmers will not grow what will not pay them.

5849. Do you come to the conclusion that 29s. per ton for potatoes will not induce your Department to take any steps ?—It will not induce the farmers to grow potatoes, and therefore it will not induce the Department to take such steps as are necessary to start the industry.

5850. (*Mr. Tyrer.*) Might I ask this question, following upon Mr. Nicholson's, with regard to the cost of revenue interference and supervision; do your figures given in your Table exclude all idea of that ?—They do.

5851. You went to Germany to investigate the question ?—Yes.

5852. What amount of supervision did you see in the agricultural distilleries ?—At two of the three distilleries I visited, I met an Excise official, and in each distillery the distilling apparatus and the receiver were all sealed.

5853. (*Chairman.*) But you did not give very much attention to that part of the question, because you were concerned only from the agricultural point of view ?—That is so. My instructions were to collect information in order to obtain an idea as to what price per ton could be paid for Irish potatoes to be used in a distillery.

5854. I think that the discussion of the subject which we have had here to-day makes it perfectly clear that the figure at which you had arrived as the maximum figure that a distiller in this country could afford to pay for potatoes, viz. 29s. per ton, is too high ?—It is much too high, evidently.

APPENDICES.

APPENDICES.

TABLE OF CONTENTS.

No.		PAGE.
I.	Duties and Allowances on British Spirits and Duties on Foreign Spirits -	229
II.	A.—Regulations as regards use of Spirit for Industrial, etc., purposes in the United Kingdom :	
	(1) Methylated Spirit - - - - - - - - -	233
	(2) Spirit denatured with other substances than Wood Naphtha - - - - - - - - - - -	239
	(3) Undenatured Alcohol in Universities, Colleges, etc. -	243
	B.—Quantities of Unmineralised Methylated Spirit used in Manufactures, etc., during the year ended 31st March, 1901 -	245
	C.—Quantities of Spirits, etc., used in making Methylated Spirits, and of Methylated Spirits produced, for five years ending 31st March, 1904 - - - - - - - - - - - - - -	247
III.	Regulations as regards use of Spirit for Industrial, etc., purposes in Germany	248
IV.	Do. do. do. in France -	260
V.	Do. do. do. in Switzerland	264
VI.	Do. do. do. in Austro-Hungary, Russia, Holland, United States, and Belgium - - -	271

APPENDIX NO. I.

DUTIES AND ALLOWANCES ON BRITISH SPIRITS AND DUTIES ON FOREIGN SPIRITS.

The duty (Excise) on British spirits is at present 11*s.* per gallon at proof.

When British spirits are exported (or used for certain operations in bond), not only is the duty of 11*s.* remitted, but an allowance also is paid by the Inland Revenue at the rate of 3*d.* per proof gallon on plain spirits, and of 5*d.* per proof gallon on compounded spirits..

These allowances are commonly spoken of as the "allowances on British spirits."

The duty (Customs) on Foreign Spirit is at present—

On Brandy and Rum 11*s.* 4*d.* per proof gallon,

On other sorts 11*s.* 5*d.* per proof gallon,

(with certain special rates for liqueurs and perfumed spirits and for spirits imported in bottle).

The difference (4*d.* or 5*d.* as the case may be) between the duty on British spirits and that on Foreign spirits is commonly spoken of as "the Surtax on Foreign spirits," or more briefly as "the Surtax."

Both the Allowances and the Surtax which date from 1860 (when the old protective duties were done away with), aim at the same purpose, which is, not to put the British producer of spirits in a position of advantage as compared with his foreign or colonial competitor, but to save him from being placed in a position of disadvantage.

In imposing a heavy duty on British spirits, it is necessary at the same time to impose on their manufacture restraints designed to prevent any spirit from escaping the duty. These restraints have the effect of appreciably increasing the cost of manufacture; and in consequence the burden of the duty on the British producer of spirit is not adequately measured by the figure of the duty alone, but must be measured by that figure plus the figure by which the cost of manufacture is increased by the excise restrictions.

Accordingly if we take x pence per proof gallon for this latter figure, and 11*s.* per proof gallon as the duty on British spirit, the full burden of the tax on the producer of British spirit per proof gallon is represented by the expression (11*s.* + x d).

It follows that, when the producer of British spirit sends out his goods to compete in neutral markets, he is entitled to relief to the extent of 11*s.* + x d. and not of 11*s.* only, per proof gallon: and conversely that foreign goods should not be admitted to the home market at a less charge than 11*s.* + x d. per proof gallon.

The values of x have varied from time to time according to the following table:—

	Surtax.			Allowances.	
	Rum.	Brandy.	Other Sorts.	Plain Spirits.	Compounded Spirits.
From 1860 -	2d.	5d.	5d.	2d.	3d.
„ 1881 -	4d.	4d.	4d.	2d.	4d.
„ 1902	4d.	4d.	5d.	3d	5d.

The determination of values for x is a matter of extreme difficulty. To arrive at it, it is necessary to take into account—

(*a.*) The tax, if any, on materials of manufacture:

(*b.*) The effect of Excise restrictions on the cost of manufacture.

At the present time (*a*) is a negligible quantity. For, although there is a tax on sugar and glucose, these materials enter into distillation of spirits to so small an extent that the tax may be left out of account. Molasses used for distilling is duty free.

As regards (*b*), the Excise restrictions that do, or may, affect the cost of manufacture are numerous, but the principal among them are the following:—

(1.) The prohibition against brewing or distilling simultaneously:

(2.) The prohibition against mixing worts during fermentation:

(3.) Compulsory stoppage of work between Saturday and Monday:

(4.) Restrictions on the manufacture of yeast:

(5.) Separation of distillery and rectifying premises and loss of duty on spirits rectified.

(No. 5 hardly affects the cost of manufacture of "plain spirits.")

From this enumeration of the factors which have to be taken into account, it will be obvious that anything like precise accuracy in fixing values for x is unattainable.

The manner in which the rates of Surtax were originally computed in 1860 is shown in the following table, which was first published in the Board of Inland Revenue's Thirteenth Report (1870), and which in the literature of the subject has since been frequently reproduced.

	1866. Amount claimed by		Amount allowed in 1860.	1866. Considered admissible by this Department.	
	Scotch Distillers.	English Distillers.		For Uncoloured Spirits.	For Coloured Spirits.
	d.	d.	d.	d.	d.
1st.—Compensation for duty on Foreign grain.	$0\frac{3}{4}$	$0\frac{3}{4}$	$0\frac{3}{4}$	$0\frac{3}{4}$	$0\frac{3}{4}$
2nd.—Prohibition against brewing and distilling at same time.	$1\frac{1}{2}$	$1\frac{1}{2}$	1	1	1
3rd.—Against distillers mixing wort in separate vessels while in process of fermentation.	$0\frac{1}{4}$	$0\frac{1}{4}$	$0\frac{1}{4}$	$0\frac{1}{4}$	$0\frac{1}{4}$
4th.—Loss of duty on rectification and flavouring spirits in separate premises.	3	3	1	$2\frac{1}{4}$	$2\frac{1}{4}$
5th.—Colouring matter in Foreign spirits.	2	2	2	Nil	$2\frac{1}{2}$
6th.—Increased expense in making malt consequent on Excise restrictions.	$0\frac{1}{4}$	$0\frac{1}{2}$	Nil	Nil	Nil
7th.—Difference in mode of charging duty in favour of Foreign spirits.	1	$1\frac{1}{2}$	Nil	Nil	Nil
8th.—Duty evaded upon Foreign spirits, and by samples drawn in bond.	$0\frac{1}{4}$				
	9	$9\frac{1}{2}$	5	$4\frac{1}{4}$	$6\frac{3}{4}$

In the period that has elapsed since 1860, appreciable changes have taken place in the conditions of manufacture of spirit and in the rate of duty on spirit, and a computation to-day of the figures at which the rates of Surtax should stand would be based on items and on values that would differ materially from those shown in the original table. Of the composition of the rates as they now stand there is no accepted or authoritative analysis, and all that can be said of them is that they represent the outcome, by way of compromise, of prolonged controversy renewed at frequent intervals, as occasion for question presented itself, during a period extending over more than forty years.

It may, however, be convenient to say a few words as regards the increase by 1d. of the Allowances and of the Surtax on Spirits other than Rum and Brandy, which was made in 1902 at the time when the duty on corn was re-imposed. For the retention of the increase, notwithstanding the repeal of the corn duties in 1903, has been a frequent subject of criticism.

The imposition of the corn duties was the occasion rather than the cause of the addition to the Allowances and the Surtax.

For, taken by themselves, it was calculated that the duties, as first proposed, would not have warranted a larger addition than $\frac{6}{10}$ths of a penny, nor, as finally passed, with a reduced duty on maize, a larger addition than $\frac{3}{10}$ths of a penny.

But for some years prior to 1902 the distillers had been urging on the Treasury and the Board of Inland Revenue that the old rates of Allowance and of Surtax were insufficient—(notably on the occasion when in March, 1898, a deputation representing the whole trade waited on the then Chancellor of the Exchequer)—and the expert officers of the Excise had admitted that they could not dispute the arguments in favour of *some* increase in the rates.

What the amount of increase should be was a matter more difficult to determine, and it was still in question when the revival of the corn duties took place.

That event made action imperative, and an additional penny was agreed to—the addition, however, not to extend to Brandy or Rum, which are not made from grain.

When the duties were repealed in 1903 the question arose as to an adjustment of the rates of Allowance and Surtax. But as the adjustment could not have exceeded $\frac{3}{10}$ths of a penny, and as the composition of the remainder of the rates was far from precise, it was decided that no change should be made.

APPENDIX NO. II.

A.—REGULATIONS AS REGARDS USE OF SPIRIT FOR INDUSTRIAL, ETC., PURPOSES IN THE UNITED KINGDOM.

The Customs and Excise Taxes on Spirits are:—

CUSTOMS—11s. 4d. per proof gallon on Rum and Brandy.

,, 11s. 5d. ,, ,, ,, other Spirits.

EXCISE—11s. per proof gallon.

DUTY FREE SPIRIT.

I. METHYLATED SPIRIT.

There are two kinds of methylated spirit.

A.—"Ordinary" Methylated Spirit for use in manufacturing operations.

This consists of a mixture of 90 parts of ordinary ethylic alcohol of a strength of 60 to 66 o.p. (*i.e.* containing from 91 to 95 per cent. of real alcohol) and 10 parts of wood naphtha of an approved type.

The official regulations do not require the British or Foreign spirit used to be of a greater strength than 50 o.p. (86 per cent. alcohol), and Colonial rum of a strength of only 20 o.p. (69 per cent. alcohol) may be used; but in practice rum is now never methylated, and the spirit is always over 60 o.p. (91 per cent. alcohol).

No duty is paid on British spirits used for making methylated spirit, and Foreign and Colonial spirits are exempt from the ordinary spirit tax of 11s. per proof gallon; but Foreign spirits have to pay a Customs surtax of 5d. per proof gallon, equivalent to about 8d. per gallon on the spirits as actually methylated. The surtax on Colonial rum is 4d. per proof gallon, equivalent to about 6½d. per gallon at 60 o.p., or less than 5d. per gallon, if rum of 20 o.p. were used for methylating.

Methylated spirit can only be made by—

1. Distillers.
2. Rectifiers, *i.e.* persons who redistil duty-paid spirit.
3. Licensed methylators.

In practice methylated spirit is, as a rule, made by methylators, who pay an annual licence of £10 10s.

All methylators have to provide suitable mixing rooms, vats, locks, fastenings, and appliances for weighing, measuring, and mixing the spirits and wood naphtha, and the necessary desks for the convenience of the Revenue officials who supervise the operations. Mixing vats must be of a capacity of 550 gallons, and wood naphtha vats of 100 gallons.

Spirits for methylation come from Customs or Excise duty-free warehouse accompanied by official permits, and are received by a Supervisor and Officer of Inland Revenue, who examine and check the strength and quantity, and see the spirits run into the mixing vats. To the spirit in each vat is then added one-ninth of its bulk of approved wood naphtha. The contents of the vat have to be thoroughly mixed, and the total quantity and strength again measured by the officials. An official entry of these particulars is made, and the vat and its contents are then handed over to the methylator for disposal in accordance with prescribed regulations. Not less than 500 gallons of methylated spirit must be made at each mixing.

The wood naphtha used for mixing with the spirit must be approved by the Board of Inland Revenue before it is used. For this purpose a sample is drawn from the naphtha vat and sent to the Government Laboratory for examination, the vat itself being locked up by the Revenue officer until the Principal of the Government Laboratory has certified that the naphtha is fit for methylating purposes. The nature of the examination to which the naphtha is submitted is described below, page 236, and from this the character of the wood naphtha used for methylating purposes in this country can be gathered.

" Ordinary " or manufacturing methylated spirit can be sold by methylators only to persons authorised by the Board of Inland Revenue to receive this kind of spirit.

A user of this spirit must send to the methylator an official requisition signed by himself, and on which there is a certificate signed by the local Supervisor of Inland Revenue that the applicant is authorised to receive such spirit. Less quantities than five gallons cannot be supplied. The methylator has to enter the particulars of every consignment in an official permit taken from a book supplied to him by the Supervisor, and this permit must accompany the spirit to the premises of the user, and be delivered to the Officer of Inland Revenue when he visits the premises.

When any person wishes to use methylated spirit in any manufacturing process, or for making embrocations, lotions, medicaments or other preparations, written application has to be made to the Board of Inland Revenue. The particular purpose for which the spirit is intended to be used, with some general description of any manufacturing process involved, has to be given, and also a statement of the situation of the premises and of the quantity of spirit likely to be used annually.

After inquiry by the local officials the Board issue their authority for the use of the spirit, and instruct their officers to supply the applicant with a book of Requisition Forms, in order to enable him to obtain a supply of the spirit from a methylator.

Where the quantity of methylated spirit used exceeds 50 gallons per annum, a bond, with one or more sureties in sums of £200 to £1,000, for the due observance of any conditions that may be imposed and the proper use of the spirit, is required. Hospitals, infirmaries, colleges and other public institutions are not usually required to give a bond.

Methylated spirit is not allowed to be used for manufacturing purposes on any premises where ordinary alcoholic beverages are made or sold, nor for the preparation of any article of food or drink, or to be mixed with any medicine capable of being taken internally. With these exceptions methylated spirit may be used in almost any art or manufacture, and is, as a fact, used for a very great variety of manufacturing and technical purposes. For medicinal and pharmaceutical purposes, for instance, the use of methylated spirit has been sanctioned for the extraction, crystallisation and purification of nearly 500 resins, oils, alkaloids, synthetical perfumes and other substances where the finished products contain none of the spirit; for making several hundred embrocations, lotions, liniments and other medicines for outward application; for most veterinary medicines; and for making collodion, flexible collodion, surgical bandages, iodoform, chloroform, ethyl and methyl chloride and bromide, and other articles used in surgery and medicine.

As a rule the conditions imposed on the users of methylated spirit are very simple, and interfere very little, if at all, with the manufacturing operations. It must not be removed from the premises where its use has been allowed, and the manufacturing operations have to be carried on substantially in the method described in the application. Any material alteration of the process, or those portions of it where the spirit is used, has to be notified to the Revenue officials, and the Board's sanction obtained for the change, but this is merely for the information of the inspecting officers, and permission for any desired alteration is rarely or never refused.

In a great many cases the methylated spirit used in the manufacturing operations is wholly or partially recovered and used over and over again. Where this recovery includes redistillation the Revenue permission has first to be obtained, and in some cases, where the manufacturing operation and the redistillation might so purify portions of the spirit as to render it capable of being used for potable purposes, special conditions are imposed, such as the collection of the whole of the distillate in one receiver and not in fractions, or the immediate mixture of the recovered spirit with fresh methylated spirit, or with some other substance.

As a whole, however, there is very little interference by the Revenue officers. Except for periodical inspections, and the occasional sampling of the recovered spirits and of the intermediate and finished products of the operations, manufacturers are left to carry out their operations in any way they please, provided they supply the Revenue authorities with sufficient information to enable the officers to see where and how the spirit is used.

Neither the methylators nor the manufacturers have to pay anything towards the cost incurred by the Revenue authorities in supervising the making, or the use of the methylated spirit.

B. "Mineralised" Methylated Spirit.

This is the methylated spirit which is sold by retail to the general public for use for burning in spirit lamps, for cleansing and domestic purposes generally, and also to some extent for mixing with paints, stains, varnishes, etc., and for polishing purposes by cabinet makers, etc.

In making "mineralised" methylated spirit the alcohol is first mixed with the wood naphtha as in making "ordinary" methylated spirit. After mixing with the wood naphtha, the whole contents of the vat of "ordinary" methylated spirit, or a portion of the spirit, not less than 100 gallons, removed to another vat, is further mixed with three-eighths of one per cent. (·375 per cent.) of an approved "mineral naphtha." This mineral naphtha is an ordinary light mineral oil having a specific gravity of from 0·800 to 0·830. The addition of this mineral oil does not interfere with the purposes for which this kind of spirit is mainly used, viz: burning in spirit lamps, etc. Its use was introduced

some fifteen years ago in order to prevent the drinking of the "ordinary" methylated spirit which was found to be going on to a limited extent among certain classes in the poorer districts of Glasgow and other large cities.

Persons who wish to retail "mineralised" methylated spirit must obtain a licence costing 10s. annually. Anybody except distillers and publicans may obtain this licence. Retailers of "mineralised" methylated spirit are furnished with a book of Requisition Forms to enable them to obtain their supplies of such spirit from the methylators.

Methylators are not allowed to sell the spirit to retailers in greater quantities than fifty gallons, or in less quantities than five gallons, but the smaller retailers are allowed to purchase it in quantities not exceeding a gallon at a time from any other retailer. The stock of "mineralised" methylated spirit which a retailer may keep is limited to fifty gallons, and he is not allowed to sell to any person a greater quantity of such spirit than one gallon at a time.

Retailers are also prohibited from selling the spirit between ten o'clock on Saturday evening and eight o'clock on the following Monday morning; and, in exceptional cases, they have to keep a stock account of all spirit received and sold, and the names of the persons to whom it is sold. These regulations are for the purpose of preventing the illicit drinking of the spirit which still occasionally occurs in some localities, and are required more for police than Revenue purposes.

Anyone may buy "mineralised" methylated spirit from a retailer, and may use it for any purpose except in the preparation of beverages or of medicines capable of being taken internally. All attempts to purify or prepare the spirit for use for these purposes are also prohibited; and any one who sells, for use as a beverage or as medicine, or has in his possession any methylated spirit, or any derivative thereof, prepared or purified for such use, incurs a penalty of £100.

THE EXAMINATION OF WOOD NAPHTHAS.

The wood naphtha must be sufficiently impure to impart to the methylated spirits, prepared by mixing one part of the wood naphtha with nine parts of spirits of wine, such an amount of nauseousness as will, in the opinion of the Principal of the Government Laboratory, render such mixture incapable of being used as a beverage, or of being mixed with potable spirits of any kind without rendering them unfit for human consumption.

Wood naphtha submitted for approval should conform to the following tests:—

(*a.*) Not more than 30 c.c. of the naphtha should be required to decolourize a solution containing 0·5 gram of bromine.

(*b.*) The naphtha, which must be neutral or only slightly alkaline to litmus, should require at least 5 c.c. of deci-normal acid to neutralise 25 c.c. of the spirit when methyl orange is used as the indicator.

It should contain:—

(*a.*) Not less than 72 per cent. by volume of methyl alcohol.

(*b.*) Not more than 12 grams per 100 c.c. of acetone, aldehydes, and higher ketones, estimated as "acetone", by the formation of iodoform according to Messinger's method.

(*c*.) Not more than 3 grams per 100 c.c. of esters, estimated as methyl acetate by hydrolysis.

The following details of the manner in which the above tests are conducted in the Government Laboratory have been published for the information of the Trade :—

Bromine Decolourisation.

A standard bromine solution is made by dissolving 12·406 grams of potassium bromide and 3·481 grams of potassium bromate in a litre of recently boiled distilled water.

50 c.c. of this standard solution (= 0·5 gram bromine) are placed in a flask of about 200 c.c. capacity, having a well-ground stopper. To this is added 10 c.c. of dilute sulphuric acid (1 in 4) and the whole shaken gently. After standing for a few minutes the wood naphtha is slowly run from a burette into the clear brown solution of bromine until the latter is completely decolourised. Not more than 30 c.c. of the wood naphtha should be required for this purpose.

Methyl Orange Alkalinity Test.

The naphtha should be faintly acid to phenolphthalein, slightly alkaline or neutral, rarely acid to litmus, and always alkaline to methyl orange. 25 c.c. of the wood naphtha are placed in each of two beakers, and titrated with deci-normal acid, using in the one case a few drops of litmus solution, and in the other of a solution of methyl orange, as indicator. With litmus usually 0·1 to 0·2 c.c. of deci-normal acid is required to neutralise. With methyl orange the total alkalinity should be greater—at least 5 or 6 c.c. of deci-normal acid being required for neutralisation.

The total alkalinity, less that given with litmus, is the "methyl orange alkalinity," and, for the 25 c.c. of wood spirit, should not be less than is required to neutralise 5 c.c. of deci-normal acid.

Estimation of Methyl Alcohol.

22 grams of coarsely powdered iodine and 5 c.c. of distilled water are placed in a small flask and cooled by immersion in ice-cold water. Then 5 c.c. of the wood spirit (60·0 o.p.) are added, the flask corked, the contents gently shaken, and allowed to remain in the ice-cold bath for 10–15 minutes.

When well cooled, 2 grams of red phosphorus are added to the mixture of spirit and iodine in the flask, and the latter is immediately attached to a reflux condenser.

The reaction soon commences, and must be moderated by dipping the flask into a cold water bath. (Spirit may be lost if the reaction is too violent.) After about 15–20 minutes, when all action appears to have ceased, the water bath under the flask is gradually heated to a temperature of about 75° C. (167° F.), and the flask being occasionally shaken is allowed to remain at this temperature for 15–20 minutes. The source of heat is then removed, and the apparatus left for an hour till it has cooled, when the condenser is reversed, and the methyl iodide slowly distilled off—first at a low temperature—the bath being allowed to boil towards the end of the operation only. The end of the condenser dips into water in a measuring tube, and the iodide is collected under water and measured at a temperature of 15·5° C. (60° F.)

The percentage (by volume) is found from the formula :—

$$\frac{\text{c.c. methyl iodide found} \times \cdot 647 \times 100}{\text{c.c. wood spirit taken.}} = \text{Percentage (by volume) of methyl alcohol.}$$

Or when 5 c.c. of spirit are taken :—

c.c. methyl iodide $\times$ 12·94 = percentage (by volume).

Esters, acetals, etc., also yield methyl iodide by this process, and from the percentage of methyl alcohol calculated as above, an amount equivalent to the percentage of these substances present must be deducted. Practically, however, methyl acetate is the only compound usually found in quantity sufficient to materially affect the result. The grams of methyl acetate per 100 c.c. of spirit multiplied by ·5405 give the equivalent of methyl alcohol to be deducted from the total percentage by volume calculated from the methyl iodide found.

The Acetone Reaction.

25 c.c. of normal soda are placed in a flask similar to those used in the bromine reaction. To this is added 0·5 c.c. of the naphtha. The mixture is well shaken, and allowed to stand 5–10 minutes. Into it from a burette n/5 iodine solution is run slowly, drop by drop, vigorously shaking all the time till the upper portion of the solution, on standing a minute, becomes quite clear. A few c.c. more of n/5 iodine solution are added, as to get concordant results an excess of at least 25 per cent. of the iodine required must be added. After shaking, the mixture is allowed to stand for 10–15 minutes, and then 25 c.c. normal sulphuric are added. The excess of iodine is liberated, titrated with n/10 sodium thiosulphate solution and starch, and half the number of c.c. of thiosulphate solution used are deducted from the total number of c.c. of iodine solution used. The difference gives the amount of acetone by weight in the naphtha by the formula :—

c.c. n/5 iodine solution required $\times$ ·3876 = grams of acetone per 100 c.c. of wood naphtha.

This includes as acetone any aldehydes, etc., capable of yielding iodoform by this reaction.

If the quantity of "acetone" is excessive, a less quantity of the spirit is taken, or 10 c.c. are diluted with 10 c.c. of methyl alcohol free from acetone, and 0·5 c.c. of the mixture is used.

Estimation of Esters.

5 c.c. of the wood naphtha are run into a silver pressure flask of about 150 c.c. capacity, together with 20 c.c. of recently boiled distilled water. 10 c.c. of normal soda solution are added, the flask securely closed and digested for at least two hours in a water bath at 100° C. (212° F.) The contents are then washed into a beaker, and titrated with normal acid and phenolphthalein. The difference between the number of c.c. of soda taken and of the acid required for neutralisation may be calculated as methyl acetate (weight in volume) from the formula :—

$$\frac{\cdot 074 \times \text{c.c. soda required} \times 100}{\text{c.c. naptha taken.}} = \text{grams per 100 c.c.}$$

Or if 5 c.c. of spirit are taken as above :—

1·48 $\times$ c.c. soda required = grams of methyl acetate per 100 c.c. of spirit.

II. Spirits Denatured with other Substances than Wood Naphtha.

Under the powers conferred on them by the Spirits Acts, 1880, and Section 8 of the Finance Act of 1902, the Commissioners of Inland Revenue have authorised the use of Ethyl and Methyl alcohol denatured with substances other than wood naphtha to be used in certain manufacturing operations.

The denaturing substance is, as a rule, one used in the manufacturing operations involved, and there are special conditions as to the mode of working and supervision by the Revenue officials, including in some cases the constant presence of one or more Excise officers on the premises whilst open for work. Traders using these specially denatured spirits have to pay the cost of the Revenue supervision.

Copies of (*a*) the Commissioners' Minutes on Section 8 of the Finance Act 1902, and (*b*) a memorandum indicating the procedure to be observed in connection with the use of Spirits under that section, are subjoined.

(*a*) Minute of the Board of Inland Revenue on Section 8 of the Finance Act, 1902.

The Board take into consideration Section 8 of the Finance Act, 1902, which runs as follows:—

> 1. Where, in the case of any art or manufactare carried on by any person in which the use of spirits is required, it shall be proved to the satisfaction of the Commissioners of Inland Revenue that the use of methylated spirits is unsuitable or detrimental, they may, if they think fit, authorise that person to receive spirits without payment of duty for use in the art or manufacture upon giving security to their satisfaction that he will use the spirits in the art or manufacture, and for no other purpose, and the spirits so used shall be exempt from duty:
>
> Provided that foreign spirits may not be so received or used until the difference between the duty of customs chargeable thereon and the duty of excise chargeable on British spirits has been paid.
>
> 2. The authority shall only be granted subject to a compliance with such regulations as the Commissioners may require the applicant to observe for the security of the revenue, and upon condition that he will, to the satisfaction of the Commissioners if so required by them, render the spirits unpotable before and during use, and will from time to time pay any expenses that may be incurred in placing an officer in charge of his premises.
>
> 3. If any person so authorised shall not comply with any regulation which he is required to observe, he shall, in addition to any other fine or liability, incur a fine of fifty pounds.

It is in the first place to be observed that the privilege of using spirit duty-free, as contemplated by the section, is to be a personal privilege, entailing personal obligations on the person or persons to whom it is granted; and it follows from this that there can be no question of the Board's granting any general authority under the section to classes of persons, but that each person or body of persons who desires to obtain the benefit of the section must make separate application to the Board, who will consider all the circumstances of each separate application, and form their judgment upon them.

At the same time, in laying down some general principles by which they will be governed in dealing with applications submitted to them, it may be possible for the Board to indicate certain classes of cases to which the benefit of the section could not, under any circumstances, be conceded, and so to prevent the multiplication of applications which cannot possibly be entertained favourably.

With this view, and also for the purpose of affording guidance generally to the public and to their own officers with respect to their policy in administering the law, as laid down in the section, the Board proceed to embody in this Minute the following observations on the subject.

The Section requires that before the Commissioners can authorise the use of spirits in any "art or manufacture"—terms which they interpret as including the application of spirit to Scientific purposes—two main conditions must be fulfilled, viz.:

(*a*) It must be proved, to the satisfaction of the Commissioners, that the use of methylated spirits is unsuitable or detrimental for the particular purpose; and

(*b*) The security of the revenue must be guaranteed by such means as the Commissioners may require

These conditions are cumulative, not alternative—Unless both can be fulfilled there can be no question of a grant of the authority contemplated by the section. In every case therefore it will be necessary to scrutinise in the first instance the objections that may be alleged to the use of methylated spirits, and it is only after the validity of such objections has been admitted, that it will be necsesary to proceed to consider whether, or by what means, the security of the revenue can be guaranteed.

It was explicitly stated in the House of Commons, both by those who promoted legislation in the sense of the section, and by the Chancellor of the Exchequer who assented to it on behalf of H. M. Government, that it was to be understood that the Commissioners should exercise the discretion conferred upon them with great caution, and with a very strict regard to the security of the revenue; and the Board themselves feel strongly that no other attitude would be possible for them.

They intend therefore to insist on a strict observance of the prescribed conditions in every case in which they may grant an authority under the section, and they will not hesitate to reject any application in respect of which it appears to them that the conditions are not, or cannot be, adequately complied with.

Further, as the duty on Spirits is so heavy and of so much importance to the revenue, they consider that they may properly require that the advantage to be obtained by the use of duty-free spirit should be substantial both in character and in weight, and that the benefit of the section should not be accorded in cases of trivial importance or in the purely personal interest of individuals.

In accordance with these principles, the Board will refuse to entertain applications under the section, as follows:—

In Respect of Condition (*a*).

Where in an Art or Manufacture the use of methylated spirit is attended by only slight and immaterial disadvantage.

In Respect of Condition (*b*).

Where the security of the revenue cannot be guaranteed with reasonable certainty, and at reasonable cost of convenience to the department.

(The cost in money will be a matter always affecting the applicant).

It is manifest that there must be many cases in which the protection of the revenue would be impossible, if the use of duty-free spirit were permitted, and of these there may be mentioned the following :—

(*i*) The manufacture of articles intended for human consumption, such as Medicines, Essences and Tinctures.

(*ii*) The manufacture of articles not intended for human consumption, but capable of being so used, if made with pure spirit or with spirit only temporarily rendered unpotable, such as Perfumes or spirituous mixtures for purposes of illumination or of generation of heat or motive power.

As regards cases to which the benefit of the section may be extended, the Board may say generally that they will be disposed to entertain favourably applications :—

(1) From recognised bodies formed for the advancement of science, or of scientific education, and requiring to use pure spirit in processes of research or of illustration. Applications of this kind from isolated individuals will not commonly be entertained ; but might be so on the recommendation and guarantee of a recognised scientific body.

(2) From persons engaged in an industrial enterprise of such magnitude and importance as to give to it a character of public interest in its bearing upon national trade. In any such case the concession will commonly be made subject to an obligation to render the spirit unpotable before and during use, by such means as may be found to be most appropriate to the particular circumstances of the manufacture. Only in very rare instances can the Board contemplate the use of pure spirit in manufacture, and then only subject to close and constant Excise supervision.

In every case of concession, of whatever kind, the persons authorised will be subject to Excise visitation, and to the observance of such regulations as regards receipt, storage, use, or recovery of spirits, and the keeping of accounts of the same, as the Board may prescribe.

H. W. P.

July, 1902.

(*b*) PROCEDURE TO BE OBSERVED IN CONNECTION WITH THE USE IN MANUFACTURES OF SPIRITS ON WHICH DUTY HAS NOT BEEN PAID (SEC. 8 OF THE FINANCE ACT, 1902).

1. Any person desiring to use spirits without payment of duty in any manufacture carried on by him must make application in writing to the Commissioners of Inland Revenue for authority to receive and use such spirits, and must prove to the satisfaction of the Commissioners that the use of Methylated Spirits would be unsuitable or detrimental.

2. The applicant must give full particulars of the situation of the premises upon which and the purpose for which the spirits are to be used, together with a description of the process of manufacture. He must also state the means by which it is proposed to make the spirits unpotable before and during use, and the quantity likely to be required in the course of a year.

3. Spirits on which duty has not been paid may not be delivered for removal to the premises of any person for use in any manufacture except from a Duty Free Warehouse, and upon production to the Officer of that Warehouse of a Requisition signed by the person authorised to receive the spirits, on which there is a certificate, signed by the Supervisor of the District, that the Applicant is authorised by the Commissioners of Inland Revenue to receive such spirits.

4. The quantity of spirits to be received at one time must not be less than one hundred bulk gallons, and the spirits must be conveyed direct to the premises of the person authorised to receive them, and must there

remain without alteration or change in the cask or package in which they were delivered, until an account thereof has been taken by the proper Officer, and they have been rendered unpotable in his presence.

5. Any person authorised to receive spirits on which duty has not been paid must, if so required by the Commissioners of Inland Revenue, provide upon his premises a warehouse, structurally secure to their satisfaction, and all such spirits received must be deposited and retained therein until delivered on proper notice to, and in the presence of, the Officer. He must also, if so required, provide a room approved by the Commissioners in which must be fixed a vat or other vessel of sufficient size to admit of at least one hundred bulk gallons of spirits being rendered unpotable at one time, and must also provide satisfactory accommodation for the Officer of Inland Revenue in attendance at his premises.

6. Security to the satisfaction of the Commissioners of Inland Revenue must be given for the due removal, safe custody, and proper use of the spirits, and the due observance of all regulations and conditions made by the Commissioners.

7. The substance or material to be used for the purpose of rendering spirits unpotable, and the mode in which the spirits are to be rendered unpotable, must be approved by the Commissioners of Inland Revenue, and the person authorised to receive spirits upon which duty has not been paid must, if so required by the Commissioners, provide a store to be approved by them, and used solely for storing and keeping the substance or material so approved.

8. No warehouse, room, or store provided in conformity with these Regulations shall be open before 8 o'clock in the morning or after 5 o'clock in the afternoon, but Officers of Inland Revenue shall have access at all times to the premises of any person authorised to use spirits under these Regulations.

9. Notice of the intention to remove spirits from the warehouse on the premises of the person authorised to use them for the purpose of being rendered unpotable or for use under these Regulations must be given to the proper Officer of Inland Revenue on a form of Warrant, on which must be specified the particulars of the spirits as warehoused together with the distinctive marks and numbers of the casks and the date of deposit in the Warehouse, and the spirits must be rendered unpotable in the presence of the proper Officer, who may take an account of such spirits before and on completion of the operation, and may, without payment, take samples at any time of the spirits and of any article in the manufacture of which they are used or which may be on the premises of the user.

10. Spirits which have been rendered unpotable under these regulations shall not thereafter be purified in any manner or be recovered by distillation or any other means, except with the express sanction of the Commissioners of Inland Revenue.

11. A person to whom authority is granted by the Commissioners of Inland Revenue to receive for use in any art or manufacture spirits on which duty has not been paid shall pay to the proper Collector of Inland Revenue, from time to time, such sum or sums as the Commissioners shall determine for the expense incurred for the attendance of an Officer at his premises, and shall also pay duty on any deficiency in the spirits received upon his premises which may arise from abstraction or from any cause which may in the opinion of the Commissioners not be due to natural waste.

Dated this 1st *October*, 1902.

By Order of the Commissioners of Inland Revenue.

J. B. MEERS,

Secretary.

III. UNDENATURED ALCOHOL is allowed to be used by universities, colleges, and other public institutions for research and teaching under certain conditions, a copy of which is subjoined:—

1. An Application must be made by the Governing body or their representative, stating the situation of the particular University, College, or Public Institution for Research or Teaching, the number of the Laboratories therein, the purpose or purposes to which the Spirits are to be applied, the bulk quantity likely to be required in the course of a year, and, if it amounts to 50 gallons or upwards, the name or names of one or more Sureties, or a Guarantee Society, to join in a bond that the Spirits will be used solely for the purpose requested and at the place specified.

2. The Spirits received at any one Institution must only be used in the Laboratories of that Institution, and must not be distributed for use in the Laboratories of any other Institution, or used for any other purpose than those authorized.

3. Only plain British Spirits or unsweetened Foregn Spirits of not less strength than 50 degrees over proof (*i.e.* containing not less than 80 per cent. by weight of absolute alcohol) may be received duty free, and the differential duty must be paid on the Foreign Spirits.

4. The Spirits must be received under Bond either from a distillery or from an Excise or Customs general warehouse and (except with special permission) in quantities of not less than 9 bulk gallons at a time. They will be obtainable only on presentation of a requisition signed by the proper Supervisor.

5. On the arrival of the Spirits at the Institution, the proper Revenue Officer should be informed, and the vessels, casks, or packages containing them are not to be opened until he has taken an account of the Spirits.

6. The stock of Spirits in each Institution must be kept under lock in a special compartment under the control of a professor or some reponsible Officer of the University, College, or Institution.

7. The Spirits received by the responsible Officer of the Institution may be distributed by him undiluted to any of the Laboratories on the same premises.

8. No distribution of Spirits may be made from the Receiving Laboratory to other Laboratories which are not within the same premises.

9. A Stock Book must be provided and kept at the Receiving Laboratory in which is to be entered on the debit side an account of the bulk and proof gallons of Spirits received with the date of receipt, and on the credit side an account of the bulk and proof gallons distributed to the other Laboratories. A Stock Book must also be kept at each other Laboratory in which must be entered on the day of receipt an account of the bulk and proof gallons of Spirits received from the Receiving Laboratory.

These books must be open at all times to the inspection of the Revenue Officer, and he will be at liberty to make any abstract from them which he may consider necessary.

10. The quantity of Spirits in Stock at any one time must not exceed half the estimated quantity required in a year where that quantity amounts to 20 gallons or upwards.

11. Any contravention of the regulations may involve the withdrawal of the Board's authority to use duty free Spirits.

12. It must be understood that the Board of Inland Revenue reserve to themselves full discretion to withhold permission for the use of duty free Spirit in any case in which the circumstances may not seem to them to be such as to warrant the grant of it. They have already decided that the use of duty free Spirit for the preservation of Natural History or other specimens cannot be allowed.

J. B. MEERS,
Secretary.

INLAND REVENUE,
SOMERSET HOUSE, W.C.
December, 1902.

NOTE.—"Proof Spirit" is defined by law to be such spirit as at the temperature of 51° Fahrenheit shall weigh $\frac{12}{13}$ths of an equal measure of distilled water.

Taking water at 51° Fahrenheit as unity, the specific gravity of "proof spirit" at 51° Fahrenheit is ·92308. When such spirit is raised to the more usual temperature of 60° Fahrenheit, its specific gravity compared with water at 60° Fahrenheit is ·91984.

To calculate the quantity of spirits at proof in a given quantity of spirit over or under proof strength:—Multiply the quantity of spirit by the number of degrees of strength of the spirit, and divide the product by 100. The number of degrees of strength of any spirit is 100 *plus* the number of degrees overproof, or *minus* the number of degrees underproof.

EXAMPLE:—19·8 gallons of spirits at 64·5 overproof

100 + 64·5 = 164·5 proof strength.

164·5 × 19·8 ÷ 100 = 32·571

taken as 32·5 gallons at proof.

APPENDIX No. II.

B.—ABSTRACT of the APPROXIMATE QUANTITIES of UNMINERALISED METHYLATED SPIRITS used in MANUFACTURING OPERATIONS and for other purposes in the United Kingdom during the year ended 31st March, 1901.

(Prepared from information supplied by Supervisors of Inland Revenue to the Government Laboratory in May, 1901.)

	Nature of manufacturing operations or other purposes for which the Spirit was used.	Number of Gallons used.
1	Making "finish," varnishes, lacquers, stains, paints, enamels, etc.	1,221,013
2	Soap manufacture	144,384
3	Hat making	121,104
4	Celluloid, Xylonite, etc.	106,589
5	Ether, Chloroform and Iodoform	97,906
6	Fulminates, smokeless powder, and other explosives (including War Office and Admiralty)	48,052
7	Preparation of solid medicinal extracts, medicaments, fine chemicals, etc.	39,637
8	Dissolving dyes and colours, and for dying and cleaning operations, etc.	28,943
9	Making photographic plates, emulsions, films, etc.	24,667
10	Making linoleum, pegamoid, lincrusta walton, and similar goods	21,128
11	Making embrocations, lotions, liniments, cattle and other medicines	15,410
12	Making filaments, etc. in the incandescent electric lamp manufacture	14,964
13	In piano making	7,510
14	In silk, crape, and embroidery manufactures, mainly for stiffening	8,434
15	In the manufacture of aniline and other dyes and colours	5,657
16	In making fireworks	2,720
17	Plant washes, insecticides, etc.	1,564
18	In the manufacture of rubber	1,600
19	For cleaning paint	1,150
20	In the manufacture of steel pens	1,669
21	Making blacking and leather dressings.	4,180
22	In "silvering" mirrors, etc.	477
23	In corset making	590
24	Making sheep dips	450
25	Preparing surgical dressings	1,040
26	Adjusting hydrometers, and in making compasses, thermometers, and other instruments	406
27	In oil refining	205
28	Electrotyping	128
29	Making inks	197
30	Various miscellaneous manufactures, etc., engraving, brass founding, watchmaking, china making, printers' rollers, black lead, candle making, artificial silk, artificial flowers, calico printing, cotton yarn, ropes, oil gas generators, etc.	1,487
31	Preserving specimens in museums, hospitals, infirmaries, etc., for burning in lamps, washes, lotions, and other purposes in hospitals, infirmaries, and similar institutions, and also for laboratories and educational purposes	33,780
2	For the War Office and Admiralty requirements, chiefly at Woolwich and Dockyards	30,624
	TOTAL	1,987,665

OBSERVATIONS.

The returns from which the Abstract has been prepared are in a very condensed form, and do not give in detail the various purposes for which the spirit is used nor the quantities used for each purpose when there are several. In some cases, therefore, it has been necessary to estimate the probable quantities assigned to each head, and the figures must therefore be taken as

approximate only. In the case of the largest users, however, there is no difficulty. The "Ether," "Solid Medicinal Extracts," and "Lotions" are the most doubtful, as most makers use the spirit for all three purposes.

On the whole, however, the figures given are probably very nearly correct.

The "quantities" are the quantities received during the year by the users.

The total, 1,987,665 gallons, compares with 2,075,514 gallons, the estimated quantity of unmineralised methylated spirit made during the year, showing a deficiency of 87,849, or a little over 4 per cent., due partly to waste, and partly probably to the imperfections in the returns.

It is not possible to make any separation between "Finish" and "Varnishes," etc., properly so-called, but as "Finish" is itself almost entirely used for making varnishes, or for thinning or manipulatiug those already made, and for polishing purposes, any distinction would not be of much value.

The mineralised or Retail Methylated Spirit is used mainly for burning in spirit lamps, for cleansing and domestic purposes generally, and also to some extent for mixing with paints, stains, varnishes, etc., and for polishing purposes by cabinet makers, etc.

APPENDIX No. II.

C.—COMPARISON of the QUANTITY of SPIRITS, etc., used in making METHYLATED SPIRITS, and of the METHYLATED SPIRITS PRODUCED, for the five years ending 31st March, 1904.

Year ending 31st March.	Proof Gallons of Spirits delivered for Methylation.		Total.	Average Strength.	Quantity in bulk of Spirits Methylated.	Wood Naphtha used.	Ordinary (Unmineralised) Methylated Spirit for Manufacturing Purposes.	Mineral Naphtha.	Mineralised Methylated Spirit for Retail Sale.	Total.
	British.	Foreign.			Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.
				o. p.						
1900	4,978,027	6,245	4,984,272	63·7	3,043,485	338,165	2,058,450	4,962	1,328,162	3,386,612
1901	5,070,713	120,332	5,191,045	64·3	3,158,442	350,938	2,075,514	5,377	1,439,243	3,514,757
1902	4,640,770	627,410	5,268,180	64·3	3,206,214	356,246	2,157,127	5,270	1,410,603	3,567,730
1903	4,239,688	1,210,001	5,451,689	64·9	3,305,502	367,278	2,213,580	5,472	1,464,672	3,678,252
1904	5,054,586	334,140	5,388,726*	63·5	3,295,485	366,165	2,139,784*	5,707	1,527,573	3,667,357

* The decrease in 1903-4 is mainly due to the fact that certain firms, *e.g.*, the British Xylonite Company, Nobels, and Leitch & Company, have been allowed the use of duty-free Alcohol denatured by other substances than Wood Naphtha.

The total quantity so allowed in 1903-4 was 206,452 proof gallons, which would be 125,885 bulk gallons at 64° o.p. (93·5 per cent. real alcohol).

APPENDIX No. III.

REGULATIONS AS REGARDS USE OF SPIRIT FOR INDUSTRIAL, ETC., PURPOSES IN GERMANY.

TAXES ON SPIRIT.

The spirit taxes in Germany are levied in so many different ways that it is difficult to arrive at any very accurate estimate of the average rate.

CUSTOMS.

On imported spirits of all kinds, including Arrack, Rum, French Brandy, and mixed spirits:—

Liqueurs - - - - - - 240 marks

All other Spirits—

(*a*) In casks - - - - - 160 „

(*b*) In bottles, flasks, and other vessels, 240 marks for every 100 kilograms (220 lbs), *i.e.*, from about 7¼d. to 1s. 1d. per lb.

But the tax has apparently to be paid on the gross weight of vessel and contents, and no satisfactory comparison with the British system can, therefore, be made. From 5s. to 10s. per proof gallon may be taken as an approximate estimate according to the character of the spirit and the vessels containing it.

Hamburg, Cuxhaven, Bremerhaven, and Gestemünde, and some other places, are not included in the Spirit Tax Union, and spirits coming from these "free cities" into other parts of the German Empire have to pay the customs taxes.

EXCISE.

Each distillery is allowed to produce a certain fixed quantity of spirit annually, called "The Contingent," on which is paid a "Consumption Tax" ("verbrauchsabgabe") of 50 marks per hectolitre of pure alcohol. On any excess production over the "Contingent" 70 marks per hectolitre is charged.

The "Contingent" may be increased or decreased for various reasons at any time, and there is a general revision once every five years.

Various other taxes are also levied. For these, German distilleries are divided into three classes :—

1. "*Industrial Distilleries*" (Gewerbliche Brennereien) carried on by individuals or companies solely for manufacturing purposes. These Distilleries have to pay per hectolitre of pure alcohol in addition to the "Consumption Tax"

(*a*) an "addition" (Zuschlag) of from 16 to 20 marks.

(*b*) a "distilling tax" (Brennsteuer) of from 2 to $6\frac{1}{2}$ marks.

Distilleries producing not more than 200 hectolitres of pure alcohol annually (7,700 proof gallons) are exempt from the "Distilling Tax," and the smaller distilleries pay the lower rates according to fixed scales.

2. "*Agricultural Distilleries*" (Landwirthschaftliche Brennereien) are those using as raw materials potatoes or grain grown on the owners farms, or on the farms of one or more of the owners, if the Distillery belongs to a society or company. These pay modified "additions" of from 10 to 20 marks per hectolitre of pure alcohol, and are exempt from the "Distilling Tax," or pay only from 1 to 3 marks per hectolitre; or instead of these taxes they may elect to pay a "Fermenting vat tax" (Maischbottichsteuer), of from 0·786 mark to 1·31 mark per hectolitre on the fermenting vat capacity for each fermentation.

3. "*Material Distilleries*" (Materialbrennereien) are those using berries, fruits, wine lees, grape pressings, etc.

These appear to be all very small, many of them making no more than 11 to 22 gallons of alcohol annually. In addition to the "Consumption tax" of 50 marks, they pay from 0·10 to 0·85 mark per hectolitre of material used.

The total average tax on spirits produced in "*Industrial Distilleries*" is estimated at not more than 70 marks per hectolitre of pure alcohol, equivalent to about 1s. 9d. per proof gallon, and in the "*Agricultural Distilleries*" at somewhat less—60 to 65 marks per hectolitre—or about 1s. 7d. to 1s. 8d. per proof gallon. By far the greater proportion of the spirit made in Germany is produced by the "Agricultural Distilleries."

DUTY FREE ALCOHOL.

Abstract of the German Regulations.

Spirit for employment in Industrial operations, vinegar making, cleaning, heating, cooking or lighting, as well as for educational or scientific purposes, may, after having been denatured according to the regulations, or in special cases without denaturing, on proof of the spirit having been so used, be granted freedom from the spirit taxes on the following conditions :—

The freedom from duty includes—

(*a*) The release from the "*consumption*" tax and its "*additions.*"

(*b*) The refunding of the "*fermenting vat*" tax at the rate of 0·16 marks per litre of pure alcohol so far as the spirit has been subjected to it.

(*c*) The return of the "*distilling*" tax at the rate of 0·06 marks per litre of pure alcohol.

Duty paid spirit and spirit containing more than 1 per cent. of fusel oil are not admitted for denaturing.

The denaturing is either *complete*, *i.e.* such as is deemed sufficient to make the spirit undrinkable, or *incomplete*, *i.e.* such as requires the employment of other means for the prevention of the improper employment of such spirit.

General denaturing agent for complete denaturing:—

4 parts of wood naphtha, and

1 part pyridine bases,

to each litre of which may be added 50 grams of lavender oil or rosemary oil.

Of this mixture $2\frac{1}{2}$ litres are added to each hectolitre of alcohol.

(German Methylated Spirit therefore contains 2 per cent. wood naphtha, and 0·5 per cent. pyridine bases, with optionally ·125 per cent. of a lavender or rosemary oil.)

The mixing of the general denaturing substance can only be carried out by persons who have obtained special authority for the purpose from the chief Inland Revenue Office of the district where the mixing establishments are situated. Authorised methylators have to provide rooms and vessels for storing and mixing the denaturing agents, all materials and implements necessary, and to give the officials the requisite assistance in sampling the denaturing substances and in the mixing them with the spirit. They have also to provide books of an official pattern for entering the particulars of the mixings and of the sale and transport of the denatured spirit.

The denaturing may take place in special vats erected for the purpose, or in the casks or other vessels used to transport the alcohol. Not less than a hectolitre (22 gallons) of alcohol can be denatured at a time. Before denaturing the alcoholic strength and quantity of spirit in each vessel is checked by the Excise Officer, unless such spirit has been sent in vessels under special revenue seals, and which are found intact on examination. The wood naphtha and pyridine bases used for denaturing must first be examined and approved by official chemists, samples being taken for this purpose from the vessels used for storing these materials, which remain under revenue control from the time the sample is taken until mixed with the spirit. The store vessels must contain not less than 100 litres (22 gallons) of the denaturing agents when sampled. The Excise Officers are directed to see that the denaturing materials are thoroughly mixed with the spirit.

The nature of the official examination of the wood naphtha is described in the official directions printed on page 256 from which the character of the substance used can be gathered. As compared with the British type of denaturing wood naphtha the German wood naphtha is of a more impure character, *i.e.* it contains a much larger proportion of acetone, and other substances, and less methyl alcohol.

The pyridine bases are used mainly to increase the nauseous character of the methylated spirit, and serve practically the same purpose as the mineral naphtha used in the United Kingdom and in France.

For use in motor-cars and other internal combustion engines, etc., alcohol may also be completely denatured by the addition of $1\frac{1}{4}$ litres of the "general" denaturing agent and $\frac{1}{4}$ litre of a solution of methyl violet dye, together with from 2 to 20 litres of benzol to every 100 litres of alcohol.

The ordinary completely denatured spirit and the motor-car spirit may be sold by persons who are authorised to do so by the Administration. Written application for a licence has to be made to the superior Excise official, who may exercise his discretion as to whether a licence should be given, and the licence may be withdrawn at any time if it appears advisable to disallow the sale in any particular shop. Before obtaining a licence notification must be given to the police.

The ordinary completely denatured spirit is intended for sale by retail, and may be used for any industrial purpose; for cleansing, heating, lighting and cooking, as well as for educational and medicinal purposes; but must not

be present in any substance intended for human consumption, and no attempt must be made to purify such spirit, or to add anything to it to disguise its taste or smell, nor must it be diluted under 85° (49 o.p.). Heavy penalties are imposed for any contravention of the regulations.

The general control over the retail sale of the denatured spirit is very similar to that imposed in this country, but the police appear to be more directly concerned in preventing irregularities than with us.

For general use on a large scale for industrial and manufacturing processes of all kinds, what is called "Wood Spirit denatured" alcohol is allowed to be made and sold under special conditions. This denatured spirit consists of a mixture of 100 litres of alcohol of not less than 90° (58 o.p.) with 5 litres of wood naphtha.

The denaturing of this spirit may take place either at the works where it is to be used or on the premises of authorized methylators. In the latter case the regulations as to mixing, storing, etc., are the same as in the case of the completely denatured spirit. Permission to sell this "wood spirit denatured" alcohol can only be granted by the Chief Office, and makers who sell this "wood spirit denatured" alcohol have to keep an official "Control Book" in which has to be entered particulars of all spirit denatured, and of every sale of such spirit. A balance is struck annually and duty is charged on any material loss or deficiency that may be shown unless satisfactory explanations can be given. Such spirit can only be sold to factories which can show a licence to buy "wood spirit denatured" alcohol. Any person wishing to obtain a "buying licence" must apply to the chief office of the province in which the factory where such spirit is to be used is situated. Full particulars of the purposes for which the spirit is required must be given. No person engaged in the spirit trade, or who sells denatured or undenatured spirit can obtain a licence, and a licence may be refused if any facts are known which render the use of denatured spirit in any factory undesirable. A licence is only given for one year, and the maximum quantity allowed cannot be exceeded without special authority. The "buying licence" must be produced each time any methylated spirit is purchased. The *seller* must enter on the licence the quantity sold, adding his name and the date, and must also enter each sale in an official "Control Book." Not less than 2 litres ($\frac{1}{2}$ gallon) may be sold at a time, and the seller must see that the maximum annual quantity shown on the "buying licence" has not already been supplied to the buyer.

The buyer must enter every purchase in a "Control Book" kept at the works. From these entries in the "Control Books" the buying and selling accounts are checked and the annual quantities allowed at each factory are fixed.

The denatured spirit must be stored in a special compartment at the factory, and on each occasion that any of it is removed for use in the works an entry of the quantity and particular purpose for which it is to be used must be made in the "Control Book" and a note must also be entered of the pages of the factory work books and the official business books in which particulars are to be found of the production, storage, and sale of the articles or substances in the manufacture of which the methylated spirit has been used.

On the demand of the superior Officers of the Administration these books and business books must be produced for their inspection.

Where this "wood naphtha denatured" alcohol, or the "completely denatured" alcohol is unsuitable for any particular manufacture special denaturing agents may be allowed. Denaturing with special reagents can only be made at the factories where the alcohol is to be used, and permission must first be obtained from the Chief Office of the Province for the use of such spirit.

All the special substances sanctioned for denaturing purposes have to be tested by an official chemist according to officially described methods, and the users of the denatured spirit have to pay for the analyses as well as to provide the denaturing substances, and proper stores, vessels, etc., for keeping and mixing the approved reagents with the alcohol.

The mixing takes place in the presence of officials, and the quantities of each kind of specially denatured alcohol have to be entered in a separate opening of the "Control Book," kept in separate vessels or compartments at the factory, and used under conditions applicable to the "wood naphtha denatured" alcohol already described.

A stock account of the amount of all denatured spirit on the premises of users of such spirit is to be taken at least once a year. The entries in the "Control Book" of the spirit received and used are to be checked, and the result of the comparison submitted to the Chief Office. Payment of duty on any loss of spirit shown by the account may be imposed, but only when there is reason to believe that the spirit has been used in illegal ways.

Denatured spirit may be recovered in any manufacturing operation, but permission must first be obtained. The recovered spirit may be used again for the same purpose as that for which it was previously used. If used for other purposes, or if it is purified, it has to be again denatured, and treated as fresh denatured spirit. If exempted from repeated denaturing samples are to be taken and examined, at the cost of the user, by an official chemist in order to determine whether it remains unfit for consumption. Recovered spirit may have to be stored in officially sealed vessels till again denatured. Incompletely denatured spirit must not be removed from the users premises.

For *incomplete* denaturing the following substances (special denaturing agents) may be used. They are to be added for denaturing purposes in the undernoted quantities per 100 litres of the spirit.

(*a.*) For industrial uses of all kinds:—

5 litres of wood spirit,

or 0·5 ,, pyridine bases.

(*b.*) For the production of Brewers Varnish and similar substances:—

20 litres of a shellac solution, which is made by adding 1 part by weight of shellac in 2 parts by weight of spirit of at least 90° (58 o.p.), are added to the spirit.

In this case the alcohol in the shellac solution if made under official supervision is also allowed exemption from duty.

(*c.*) For the production of celluloid and pegamoid.

1 kilogramme of camphor,

or 2 litres of turpentine,

or $\frac{1}{2}$,, benzol.

(*d.*) For the production of the following substances:—

1. Ether, ordinary (with certain limitations and regulations as to sale and use).
2. Ethyl sulphuric salts.
3. Agaricin, Podophyllin, Scammony, Guiacum and Jalap resins, as well as other resins and gum resins.
4. Aldehyde and paraldehyde.
5. White lead and acetate of lead.
6. Ethyl chloride, bromide and iodide.
7. Photographic paper and dry plates, and emulsions of chloride, bromide and iodide of silver and gelatin, and similar preparations.
8. Chloral hydrate.

9. Electrodes for electric storage batteries.
10. Acetic ether (with certain limitations as to sale and use).
11. Glucosides.
12. Rubber preparations.
13. Collodion, and bromide, chloride and iodide of silver emulsions of collodion.
14. Pancreatin, alkaloids, santonin, tannin, and salicylic acid and its salts.
15. Coal tar colours, including substances used in obtaining them, and intermediate products.
16. Chemical preparations (not otherwise named) which do not retain any spirit when finished (except formic ether, valerianic ether and butyric ether) :—

10 litres of sulphuric ether,
or 1 litre of benzol,
or $\frac{1}{2}$ „ turpentine,
or 0·025 „ animal oil.

Collodion for sale must contain at least 1/100th of its weight of gun-cotton.

(*e.*) For the preparation of Chloroform.

300 grams of chloroform.

(*f.*) For the production of Vinegar.

200 litres vinegar containing 3 per cent. acetic acid,
or 150 „ „ „ 4 „ „ „
or 100 „ „ „ 6 „ „ „
and 100 litres of water.

and so on,

or 50 litres vinegar containing 12 per cent. acetic acid
and 100 litres of water.
or 30 „ „ „ 6 per cent. acetic acid
and 70 litres of water,
and 100 „ „ „

Any excess of the quantity of acetic acid in the vinegar mixture or of the spirit are to be allowed for, and the water may be replaced entirely or in part by an equal quantity of beer, glattwasser, or natural wine.

(*g.*) For making inks, sealing wax, and stamping inks :—

0·5 litres of turpentine,
or 0·025 litres of animal oil.

(*h.*) For making Bedstead Enamels, and Brewers Varnish, as well as for use in incandescent lamps, for finishing silk ribbons, and for cleansing jewellery, etc.

0·5 litre of turpentine.

(*i.*) For making iodoform,

200 grams iodoform.

The iodoform may be dissolved in part of the spirit, and the solution then added to the remainder of the spirit.

(*k.*) For varnishes and polishes of all kinds :—

2 litres of wood spirit and 2 litres petroleum benzin.

or 0·5 ,, turpentine.

Polishes and varnishes not for use in the works of the makers, but for sale, must contain at least 1/10th part of their weight of shellac or other resin.

(*l.*) For preparing medical, botanical and zoological preparations for educational purposes :—

1 litre (commercially pure) methyl alcohol,

and 1 litre petroleum benzin.

(*m.*) Soap-making.

1 kilogramme of castor oil and 400 c.c. of soda solution.

The denaturing materials may be dissolved by heating in part of the spirit, and the solution then added to the remainder of the spirit.

(*n.*) For the production of wool fat (lanoline) :—

5 litres of petroleum benzin.

Spirit is only allowed duty free for the production of ether and acetic ether under the proviso that they are (under official control) either exported; or else used at home for industrial uses; or for the purpose of testing in scientific and technical trades or professions; or for the production of materials for surgical bandages, but not for ether-containing medicines; or for making fulminates, smokeless powders, and other munitions of war; or for use in certain Public Institutions. So far as the ether and acetic ether are not used by the maker, but are sent to other workshops, or to the named institutions and factories, the regulations as to obtaining a licence for buying, selling and using, as well as to the keeping of a control book by the sellers, are the same as in the case of "wood naptha denatured" spirit.

It will be required also that the buyers, by means of their business and manufacturing books, or by special books, shall enter the particulars of the use of the ether and acetic ether.

A buyer's licence for ether made from duty free spirit can also be given if the ether is to be exported by the buyer, or is to be sent to an authorised industrial user, institution or factory. The intermediate merchant in these cases is under the same control as the maker of ether for sale. The Superintending Officers can permit ether-makers to change ether which has been made from duty free spirit into taxed ether so that it may be used or sold for the uses excepted in paragraph 1.

In this case the ether is to be notified for taxing, its weight officially taken, and the proper duty, on the basis of 1·6 litre of alcohol for each kilogram of ether, is to be assessed. If the spirit used is subject to any other charges the highest charge is to be taken.

More particular regulations are made by the Chief Office.

The denaturing of spirit with 0·5 litre of turpentine for cleaning bijouterie, and for making polishes and lacquer varnishes which are to be used for lead pencils, toys, and clock-making can also be permitted in the

existing districts of the Chief Imperial Finance Ministry even when the spirit is not to be used in the factory of the applicant, but is to be sent to other factories. The regulations as to the sale and use of "turpentine denatured spirit" are the same as for "Wood Naptha denatured" spirit.

PURE DUTY FREE ALCOHOL.

Pure alcohol without denaturing may be delivered duty free—

(*a*) *To certain Hospitals, Lying-in Hospitals*, and Lunatic Asylums, as well as to Public Scientific Institutions.

Permission has first to be obtained from the Chief Office of the Province, and an application must be made in writing stating the purposes for which the spirit is to be used, and the extreme annual quantity required. The quantities allowed are fixed by the Chief Office and revised every three years. Not less than 25 litres (5½ gallons) can be received at a time. A stock book has to be kept by some specially designated official of the Institution, in which is to be entered particulars of the receipt and use of the spirit. The spirit may be used only *inside* these Institutions for general scientific and heating purposes and it makes no difference whether the spirit is directly used for the specified purposes or only indirectly so used, *e.g.*, to clean instruments, to disinfect the operators or operating tables, or for heating inhalation apparatus, etc.

Otherwise, the spirit can only be used for the purposes stated. It is specially forbidden to give the spirit to other persons, or to take it outside the Institutions except by special permission of the Chief Office. Duty free ether and acetic ether are allowed in the Institutions under similar regulations.

(*b*) *For making smokeless powders, fuses, and fulminates*, as well as for making the varnishes used in finishing these substances.

Permission has to be obtained and the same regulations as are applicable to the buying, storage, and use of "wood naptha denatured" spirit, and the keeping of "control books" and other accounts are enforced. At large works stock is taken at frequent intervals, and there is generally a somewhat more stringent supervision by the Excise Officers. Permission may be granted for recovery of any spirit used in the manufacturing operations. The spirit must only be used *inside* the factories and must not under any circumstances be removed from the works. Duty may be charged on any unexplained loss or deficiency shown at the stock takings. Duty free ether and acetic ether are allowed in these factories under similar regulations.

Pure undenatured alcohol was formerly allowed to be used by apothecaries, medicine makers, druggists, doctors. and veterinary surgeons for the preparation of some 80 tinctures, spirits and liquors according to the formulae of the German pharmacopœia and other authorised formulae, and also for doctors' prescriptions and for making bandages, etc. This privilege was withdrawn in October, 1902, and all medicines have now to be prepared with duty paid spirit.

No foreign spirit of any kind, nor any mixtures containing spirit, or substances made from spirit, appear to be allowed to be used duty free in Germany. All imported alcohol, alcoholic mixtures and derivatives have to pay the Customs duties before being delivered for use.

INSTRUCTIONS FOR TESTING WOOD NAPHTHA.

1. *Colour.* This shall not be darker than that of a solution made by dissolving 2 c.c. of n/10 iodine in 1,000 c.c. of distilled water.

2. *Boiling Point.* 100 c.c. placed in a short-necked copper flask of about 180–200 c.c. capacity is placed on an asbestos plate having a circular hole of 30 m.m. diameter. Into the neck of this flask is placed a fractionating tube 12 m.m. wide, and 170 m.m. long, with its side tube connected to a Liebig's condenser at least 400 m.m. long. In the fractionating tube, which is provided with a bulb about a centimetre below the side tube, is placed an offically tested thermometer with a scale ranging from 0°C. to 200°C., so that its mercury bulb is in the middle of the bulb. The flask is heated so that the distillation proceeds at about the rate of 5 c.c. per minute. The distillate is collected in a cylinder graduated in c.c.s., and at 75°C. with a normal barometric pressure of 760 m.m. at least 90 c.c. shall be collected. If the barometer is not at 760 m.m. during the distillation 1°C. shall be allowed for every variation of 30 m.m. *e.g.* at 770 m.m. 90 c.c. shall distil at 75°.3 C.; and at 750 m.m. 90 c.c. at 74°.7 C.

3. *Miscibility with water.* 20 c.c. wood spirit mixed with 40 c.c. water shall give a clear, or only slightly opalescent solution.

4. *Acetone Content.*

(*a.*) *Separation on mixing with soda solution.*

20 c.c. of wood spirit are shaken with 40 c.c. of soda solution of S.G. 1·300. At least 5 c.c. of wood spirit must separate after standing for half an hour.

(*b.*) *Titration.*

1 c.c. of a mixture of 10 c.c. of wood spirit with 90 c.c. of water, is mixed with 10 c.c. of double normal soda solution. Then 50 c.c. of n/10 iodine solution are added with continual shaking, and the mixture allowed to remain at least for three minutes. Then excess of dilute sulphuric acid is added, and the excess of iodine titrated with n/10 hypo and starch solution. At least 22 c.c. of n/10 iodine solution shall be required for the acetone.

5. *Bromine Absorption.* 100 c.c. of a solution of $KBrO_3$ and KBr (made up as under) are acidified by the addition of 20 c.c. of dilute H_2SO_4 (S.G.1·290). To this mixture the spirit is added drop by drop from a burette so long as any colour remains on shaking. The addition shall be so arranged that in one minute 10 c.c. of spirit shall be added. Not more than 30 c.c. shall be required for decolouration, and not less than 20 c.c. This test must be done in full daylight, and the temperature should not exceed 20°C.

Bromine Solution.

After at least two hours drying at 100°C., and cooling in an exsiccator, 2.447 grams of $KBrO_3$ and 8·719 grams of KBr of tested purity are dissolved in water, and the solution made up to 1 litre.

The subjoined tables show, for the three years ended 30th September, 1903, (*a*) the quantities of duty-free spirits issued for use in Germany, (*b*) the quantities denatured of the several methods allowed, and (*c*) the quantities used for particular manufactures, etc.

(a) *Quantities of Duty-free Spirit issued during*

Year ending 30th Sept.	Completely Denatured.	Incompletely Denatured.	Undenatured.	Total.	Completely Denatured.	Incompletely Denatured.	Undenatured.	Total.
	Hectolitres of Pure Alcohol.				Equivalent bulk Gallons of Pure Alcohol.			
1901	782,295	339,754	33,820	1,155,869	17,210,490	7,474,588	744,040	25,429,118
1902	704,729	345,894	59,427	1,110,050	15,504,038	7,609,668	1,307,394*	24,421,100
1903	900,190	360,730	17,792	1,278,712	19,804,180	7,936,060	391,424*	28,131,664

* The use of undenatured duty-free spirit in the preparation of medicinal tinctures and prescriptions was formerly allowed in Germany. This privilege was withdrawn after the 30th September, 1902.

The undenatured alcohol is now only allowed to be used duty-free in certain Hospitals, Asylums, and Public Scientific Institutions, and for making Smokeless Powders, etc., mainly in Government factories.

The sudden increase from 33,820 hectolitres in 1901 to 59,427 hectolitres in 1902 was probably connected with the publication of the intention of the Government to disallow the use of pure duty-free spirits for medicinal purposes, this intention being published a year in advance of the time that it was to take effect.

(b) *Methods of denaturing and quantities of Alcohol denatured in the years ending 30th September, 1901, 1902 and 1903.*

Denaturing Substance used per 100 litres of Alcohol.	1901.	1902.	1903.	1901.	1902.	1903
	Hectolitres of pure Alcohol.			Equivalent bulk Gallons of pure Alcohol.		
"Completely denatured."						
Official Mixture—						
4 parts Wood Naphtha. 1 „ Pyridin bases.						
For general use—						
2½ litres of Official Mixture ...	782,295	704,729	870,735	17,210,490	15,504,038	19,156,170
For motor engines, etc.—						
1¼ litres of Official Mixture, and 2 to 20 litres of Benzol, coloured with Methyl Violet	—	—	29,455	—	—	648,010
Total "Completely denatured"...	782,295	704,729	900,190	17,210,490	15,504,038	19,804,180
"Incompletely denatured."						
For sale—						
5 litres Wood Naphtha... ..	18,689	18,164	20,338	411,158	399,608	447,436
½ „ Turpentine	607	607	639	13,354	13,354	14,058
For use only in the factories, etc., where denatured—						
Vinegar (various proportions) ...	166,329	160,287	155,838	3,659,238	3,526,314	3,428,436
·025 litres Animal Oil... ...	66,748	75,831	79,836	1,468,456	1,668,282	1,756,392
½ „ Turpentine... ...	50,334	51,733	54,460	1,107,348	1,138,126	1,198,120
5 „ Wood Naphtha ...	2,803	2,240	2,379	61,666	49,280	52,338
10 „ Ether	11,495	11,210	14,473	252,890	246,620	318,406
1 kilogram Camphor	9,396	9,604	11,510	206,712	211,288	253,220
2 litres Turpentine... ...	5,001	4,935	7,403	110,022	108,570	162,866
1 „ Benzol	1,879	3,051	4,105	41,338	67,122	90,310
½ „ Benzol	1,144	2,356	3,525	25,168	51,832	77,550
1 kilogram Castor Oil / 0·4 „ Soda Solution ...	1,737	1,710	1,808	38,214	37,620	39,776
20 litres Shellac Solution ...	1,684	1,586	1,795	37,048	34,892	39,490
5 „ Petroleum Benzin ...	993	1,052	992	21,846	23,144	21,824
300 grms. Chloroform ...	296	671	586	6,512	14,762	12,892
½ litre Pyridin bases ...	210	509	539	4,620	11,198	11,858
200 grms. Iodoform	356	324	322	7,832	7,128	7,084
300 „ Ethyl Bromide ...	—	—	132	—	—	2,904
1 litre Commercially pure Methyl Alcohol / 1 „ Petroleum Benzin	6	—	43	132	—	946
2 litres Wood Naphtha / 2 „ Petroleum Benzin	47	24	7	1,034	528	154
Total Incompletely denatured...	339,754	345,894	360,730	7,474,588	7,609,668	7,936,060

(c) *Manufactures, etc., in which "Incompletely Denatured" Alcohol was used in the years ending 30th September, 1901, 1902 and 1903.*

Manufacture, etc.	Hectolitres of Pure Alcohol.			Equivalent bulk Gallons of pure Alcohol.		
	1901.	1902.	1903.	1901.	1902.	1903.
Vinegar	171,264	164,062	164,754	3,767,808	3,609,364	3,624,588
Polishes, Lacquers and Varnishes	66,672	65,116	68,095	1,466,784	1,432,552	1,498,090
Ether	48,265	55,747	51,609	1,061,830	1,226,434	1,135,398
Medicinal Extracts, Alkaloids, Coal Tar Colours, etc.	28,070	32,610	38,637	617,540	717,420	850,014
Celluloid	15,797	16,684	22,438	347,534	367,048	493,636
Lake paints and colours	2,741	3,460	5,397	60,302	76,120	118,734
Soap	1,737	1,710	1,808	38,214	37,620	39,776
Fulminates, Percussion caps, etc.	700	1,650	1,651	15,400	36,300	36,322
Brewers' glazes	1,447	1,328	1,421	31,834	29,216	31,262
Lanoline extraction	1,143	1,052	992	25,146	23,144	21,824
Chloroform	296	760	586	6,512	16,720	12,892
Iodoform	369	324	322	8,118	7,128	7,084
Acetic Ether	245	415	464	5,390	9,130	10,208
Ethyl Bromide	—	—	132	—	—	2,904
Surgical Dressings	—	—	345	—	—	7,590
Pharmaceutical remedies and preparations	425	425	435	9,350	9,350	9,570
Photographic emulsions, papers, plates, etc.	—	—	631	—	—	13,882
Finishing Rubber Goods	235	258	374	5,170	5,676	8,228
Inks	112	30	217	2,464	660	4,774
Miscellaenous	236	263	422	5,192	5,786	9,284
	339,754	345,894	360,730	7,474,588	7,609,668	7,936,060

APPENDIX NO. IV.

REGULATIONS AS REGARDS USE OF SPIRIT FOR INDUSTRIAL, ETC., PURPOSES IN FRANCE.

The Customs and Excise Taxes on Alcohol in France are:—

CUSTOMS (Importation).—

70 francs per hectolitre (equivalent to about 1s. 5d. per proof gallon) and

80 centimes per hectolitre (equivalent to about 1s. 7d. per 100 proof gallons) for control, etc.

These duties are in addition to the Excise duty.

EXCISE (Internal).—

220 francs per hectolitre of pure alcohol (equivalent to about 4s. 6d. per proof gallon).

DUTY FREE SPIRIT.

ABSTRACT OF FRENCH REGULATIONS.

Spirits for industrial and domestic use are freed from all taxes on condition that they are denatured, but all medicaments which contain any spirit after their manufacture pay the ordinary spirit duty. Denatured alcohol pays a statistical tax of 0·25 francs per hectolitre of pure alcohol (about 7d. per 100 proof gallons) and also 0·80 francs per hectolitre (about 1s. 10d. per 100 proof gallons) to cover the expense of the examination of the samples and the supervision of the denaturing operations.

Any person who desires to denature spirit must submit a plan of his premises and supply details as to the vats, vessels, etc., and the materials to be used for denaturing.

Denaturing takes place in presence of the Excise officials. The alcohol must be of at least 90° (58 o.p.) and contain not more than 1 per cent. of "fusel oil."

Samples of both the alcohol and of the denaturing substances to be used have to be submitted to analysis as directed by the Ministry of Finance, and all operations are supervised by the Excise officers.

Spirits may be denatured by the "general process" or by "special processes."

Denaturing by the "special" processes is usually carried out at the factories where the spirit is to be used.

General Denaturing Process.

Ten litres of wood spirit of at least 90° (58 o.p.) and containing 25 per cent acetone and 2·5 per cent of "impurités pyrogènées" for 100 litres of spirit.

Spirit denatured by this reagent is divided into two classes :—

1. *For lighting and heating and for making "finish."*—This spirit must contain, in addition to the general denaturing agent, 0·5 per cent of heavy benzine, distilling between 150° and 200° C., when used for heating and lighting, and 4 per cent. gum resin for "finish."

These spirits are allowed to be sold, under strict regulations and police and excise supervision, both wholesale and by retail to the general public, and correspond to our mineralised methylated spirit and "finish." Since 1st January, 1902, there is allotted to the makers of denatured alcohol for heating, lighting, and motive power a sum of 9 francs per hectolitre of pure alcohol (about 2½d. per proof gallon). This is to reduce the cost of denaturing for the various uses to which this alcohol is applied in competition with petrol.

2. *For Manufacturing purposes,* such as varnishes, solid extracts, solidified spirits, plastic substances, alkaloids, fulminate of mercury, transparent soap, insecticides, etc.

Manufacturers wishing to use this spirit must obtain permission. They have to keep an account of spirits received and used, and of the nature and quantity of the products manufactured by its aid.

Excise officers frequently visit the works in order to assure themselves that the products made correspond to the spirit produced.

If the products contain any alcohol they come under the same regulations as to sale, etc., as methylated spirits.

This spirit corresponds to our "Ordinary unmineralised methylated spirit," and the regulations in France are not less but more stringent than in this country.

3. Certain industries cannot use methylated spirit mixed with wood spirit, and the Ministry have authorised the employment of other processes of denaturing specially adapted to the particular necessities of each manufacturer. These are either *special* for each product, and have to be approved by the Minister, or *general* for products or classes of products already approved on the advice of the Consultative Committee.

Of the latter are:—

1. *Ethers, simple and compound.*

Alcohol is mixed with 10 per cent. of the residue (of a fixed type) of a previous operation, and 10 per cent. sulphuric acid at 66° B., or 20 per cent. at 54° B. The mixture is heated to a temperature of 80° C. for some time (prolongé) in presence of the Excise Officer.

2. *Ethyl Bromide.*

Seven litres of spirit at 93° with 8½ litres sulphuric acid at 66° and 15 grams bromine.

3. *Ethyl Iodide.*

6 litres of alcohol at 96°, 4 kilograms iodine, and 800 grams amorphous phosphorus.

4. *Ethylate of Soda.*

8 litres absolute alcohol and 500 grams soda.

5. *Nitric Ether.*

1 part nitric acid at 36° and 4 parts alcohol at 96°.

6. *Ethyl Chloride.*

1 part hydrochloric acid at 21° and 1 part alcohol at 96°.

7. *Aldehyde.*

Mix alcohol with 10 per cent. sulphuric acid at 66° B. or 20 per cent. at 54° B., and heat the mixture to a temperature of 80° C. Cool and then pour the mixture on to bichromate of potash.

8. *Chloroform.*

Mix the alcohol with 5 or 6 kilogrammes of chloride of lime in solution.

9. *Collodion.*

Equal volumes of ether and alcohol, and add gun-cotton. The mixture should represent 2 litres for each litre of alcohol, and should contain 6 grams pyroxyllin.

10. *Chloral and Chloral Hydrate.*

A current of chlorine gas is passed through alcohol. Each litre of alcohol of 95° ought to produce 780 grams of chloral hydrate.

In all these cases, as well as those in which the manufacturers are permitted to employ other special formulæ, the denaturing has to be done in presence of an Excise Officer (Agent d'Administration), and the manufacturer has to keep registers of the alcohol used, and of the products made, and to submit to visits from the officials as in the case of those who use the common methylated spirits.

The Administration furnishes the denaturing wood spirit, etc., at the expense of the makers.

The minimum quantity of spirit that can be denatured by the general formula is 20 hectolitres (440 gallons) and by any special formulæ 10 hectolitres (220 gallons).

In all the "special cases" the French regulations appear to involve the presence of an official during at least the initial stages of every manufacturing operation, and in addition a detailed return from the manufacturer of the quantity of the products he obtains and of the spirit used, and the officials have to be satisfied that the correspondence between the spirit used and the products obtained is satisfactory. Manufacturers are charged with duty on any deficiency of spirit shown by the returns or inspections.

There appears to be no provision in France for any remission of the Import (Customs) duty on spirits, and no foreign spirit is denatured.

TABLE SHOWING the QUANTITIES of DENATURED SPIRIT used in FRANCE for various MANUFACTURING PURPOSES during the years 1900-1-2-3.

Manufacture, etc., for which used.	1900.	1901.	1902.	1903.
	Gallons of pure Alcohol.			
Lighting, heating, motor engines, etc.	2,764,256	3,366,110	4,999,566	5,764,792*
Varnishes, lacquers, and polishes	385,264	360,426	312,136	317,834*
Dyeing	3,432	16,346	902	11,704*
Celluloid, etc.	158,356	111,518	87,186	101,090*
Drugs and chemical preparations	100,408	60,852	149,886	613,162
Ether and explosives	1,427,206	1,530,848	1,539,912	1,405,338
Scientific purposes	8,492	9,438	8,932	11,418
Various	19,294	78,892	88,000	15,818
TOTAL	4,866,708	5,534,430	7,186,520	8,241,156

* These spirits, as well as a large proportion of that classed under "chemical preparations" and "explosives," contain 10 per cent. of Wood Naphtha.

Since January 1st, 1902, a drawback of 9 francs per hectolitre (about 2½d. per proof gallon) has been allowed on alcohol used for lighting and heating to compensate for cost of methylating, and to enable this spirit to compete with petrol in motor cars, etc.

There was some alteration of the classification of "Drugs," "Ether," etc., in 1903.

APPENDIX No. V.

REGULATIONS AS REGARDS USE OF SPIRIT FOR INDUSTRIAL, ETC., PURPOSES IN SWITZERLAND.

CUSTOMS AND EXCISE DUTIES.

In Switzerland, the manufacture, importation, and the primary sale of alcohol is a monopoly of the Federal Government.

Farmers are permitted to distil small quantities of spirit from grapes, wine, wine-lees, wine yeast, fruits, berries, etc., grown on their own lands; but, with this exception, all kinds of distilleries have to work under the supervision of the officials of the Federal Alcohol Department, and all the spirit produced is taken over by this department at prices fixed by agreement made between the distillers and the Federal Finance Minister.

Customs Import Taxes. Brandy, liqueurs, essences, vermouth, tinctures and other special alcoholic liquors may be imported by private persons on payment of an import duty of 80 francs per 100 kilograms gross weight of spirit and vessels, where the strength does not exceed 75° (31 o.p.), and 80 centimes for each degree over that strength (equivalent to about 2s. 6d. to 3s. 6d. per proof gallon).

But all ordinary alcohol, and substances containing alcohol, come under the monopoly, and can only be imported into Switzerland by the Federal Alcohol Department.

Excise (Monopoly) Taxes. All imported alcohol, and all Swiss manufactured alcohol, has to be sent to the warehouses of the Alcohol Department of the Federal Government.

Any one who wishes to buy spirit must order it from the department in quantities of not less than 150 litres. The prices charged are fixed by law at not less than 120 francs or more than 150 francs per hectolitre of pure alcohol.

At present the ordinary "monopoly" prices are as follows:—

(a) Wein Sprit, mark A.V.W., or Kahlbaum Sprit (Fein Sprit from Kahlbaum, Berlin).

142·60 francs per hectolitre at 95° (5s. 2d. per gallon at 66 o.p., 3s. 1½d. per proof gallon.)

(b) Prima Sprit, mark A.V.P.

140·97 francs per hectolitre at 95° (5s. 1d. per gallon at 66 o.p., 3s. 1d. per proof gallon.)

(c) Fein Sprit, mark A.V.F.

138·53 francs per hectolitre at 95° (5s. per gallon at 66 o.p., 3s. per proof gallon.)

(d) Raw Potato Spirit, mark A.V.R.

131·24 francs per hectolitre at 90° (4s. 9d. per gallon at 58 o.p., 3s. per proof gallon.)

From these prices the Government profit or tax is equivalent to about 2s. to 2s. 3d. per proof gallon.

Wholesale dealing in spirit or spirituous liquors is not subject to any further licenses or taxes, but the retail sale and the regulation of public houses, etc., is under the control of the Cantonal Authorities, who may impose further taxes or licenses.

DUTY FREE SPIRIT.

Abstract of the Swiss Regulations.

The Alcohol Department are authorized to sell denatured spirits in quantities of not less than 150 litres (33 gallons) at cost price for the following purposes:—

(a) For cleansing, heating, cooking, lighting, as well as for use in motor engines.
(b) For industrial purposes generally, except the preparation of beverages, or of liquid perfumes and cosmetics.
(c) For making vinegar.
(d) For scientific purposes.
(e) For preparing pharmaceutical products which do not contain any alcohol in their finished condition, and are not mixed with alcohol when used.

The denaturing is either "absolute," *i.e.*, such as is considered sufficient of itself to render the spirit unfit for consumption as a beverage; or it is "relative," *i.e.*, such as requires official supervision in order to prevent such relatively denatured spirit being used for other purposes than those for which it is allowed.

"*Absolutely*" *Denatured Spirit.* The preparation of "absolutely" denatured spirit is exclusively reserved for the Alcohol Department, who prepare it and sell it to users and retailers in quantities of not less than 150 litres at a time, at a price of 50 francs per 100 kilograms at 93° (about 1s. 6d. per gallon at 63 o.p.). On quantities of 10,000 kilograms sent out at one time in boiler tanks a discount of 2 per cent. is allowed off this price, and from 1½ to ½ per cent. when quantites of 10,000 kilograms and 5,000 kilograms are so sent out in large and small casks.

The methods of denaturing and the substances used are regulated by the Alcohol Department.

The "absolutely" denatured spirit is used for cleansing, heating, cooking, lighting, and motor engines, and for sale by retail. The retail sale is under the control of the Cantonal Authorities.

For "absolutely" denatured spirit the composition of the denaturing mixture, is not kept constant, but for various reasons it is changed two or three times per annum. At present (November, 1904) the Department employ a mixture having the following composition:—

Acetone Oil - - - - -	700 parts.
Pyridine Bases- - - - -	100 „
Solvent Naphtha - - - -	90 „
Crude Wood Naphtha - - -	110 „
	1,000 parts.

2·7 kilograms of this mixture are added to any 100 kilograms of alcohol at 95° (about 2·7 gallons to 100 gallons of alcohol at 66 o.p.).

This proportion has been kept constant for some time, but cannot be considered as unalterable.

"*Relatively*" denatured spirit. For all manufacturing purposes, "relatively" denatured spirit is allowed to be used.

Whoever wishes to use this kind of spirit in his business must make application to the Alcohol Department on a special form.

Persons whose names are not registered in the "Trade List" have to obtain an official certificate as to the character of their establishments, and the kind of business carried on by them. The discretion as to the granting of permission is vested in the Director of the Alcohol Department, who also determines what bonds or guarantees are sufficient to prevent the improper use of such spirit.

Persons who have been allowed to use this spirit must commence operations within three months of the date of their obtaining the permission, otherwise a fresh application has to be made.

Denaturing may take place either in the warehouses of the Alcohol Department or at the premises of the users of such spirit. In the latter case the users of "relatively" denatured spirit have to obtain the pure spirit from the Alcohol Department, and have then to provide the denaturing materials at their own cost, and also premises for mixing the denaturing substances with the spirit in the presence of the officials of the Department.

The officials decide whether the denaturing substances provided comply with the regulations, and if they are not satisfied samples are taken and sent for examination by the technical chemists of the Department at Berne. Traders have also to provide the denaturing substances used at a warehouse.

The following substances have been sanctioned for "relative" denaturing in the undernoted proportions for every 100 litres of alcohol for use for the purposes specified:—

(a) *For making Vinegar.*

Five litres of absolute acetic acid dissolved in at least 200 litres of water. The water may be replaced by an equal quantity of beer, wine, yeast, yeast pressings, or similar liquids.

(b) *For preparing Lacquers, Varnishes, and Polishes.*

2 litres of wood spirit and 2 litres of petroleum benzin,
or, ½ litre of turpentine,
or, 5 litres of wood spirit,
or, 2 kilograms of shellac,
or, 2 „ of copal or resin,
or, ½ kilogram of camphor.

The denaturing with camphor will only be allowed to authorised users, who mix varnishes or polishes exclusively for use in their own workshops.

(c) *For preparing Dye Substances.*

10 litres sulphuric ether,
or, 1 litre benzol,
or, 1 „ coal tar oil,
or, ½ „ turpentine,
or, 25 grams animal oil, and
or, 25 „ aniline blue or eosin, violet, or fluorescein.
or, 100 „ naphthalene,
or, 2 kilograms commercially pure methyl alcohol,
or, ½ kilogram camphor.

For the use of other denaturing substances for other purposes special permission has to be obtained from the Federal Council.

In the case of (b) varnishes, etc., and (c) dyes, the Alcohol Department determines, in each case in which permission is granted for the use of "relatively" denatured spirit, which of the different denaturing substances given in the list shall be used.

The authorised users of "relatively" denatured spirit are required (so far as may not be in whole or part dispensed with) to keep prescribed books in which are to be entered the receipt and use of the spirit; the preparation and disposal of the products made with it; and particulars of any sale of the spirit which may be allowed.

They have also to send to the Alcohol Department, immediately after the close of every quarter, certified extracts of these books, giving full particulars of the business done during the preceding quarter, and vouching by signature for the accuracy of these reports.

Officials of the Department may at any time inspect the works, the stock of denatured spirit, and the quantities used, and of the products made with it; and may take samples, and inspect any of the business books belonging to the factory.

The trader and his servants must assist the officials of the Department and of the Customs in carrying out the denaturing, and generally in the exercise of their official supervision.

Information must also be immediately given to the officials when there has been any unusual disturbance in the manufacturing operations, or any occurrence which has caused an unusual loss of "relatively" denatured spirit, or of the products made from it.

If more than 10,000 kilograms of relatively denatured spirit are used annually at any factory, iron or other vats with gauge glasses and scales or floats, and means for official locking must be provided for storing the spirit.

Manufacturers who use both "relatively" and "absolutely" denatured spirit, and also undenatured spirit in their works, have to keep separate the processes in which each kind of spirit is used.

No distilling or rectifying apparatus must be used without the special permission of the Department either in the rooms in which "relatively" denatured spirit is being used, or in any adjoining room belonging to the authorised user.

If permission has been given to recover the spirit it must be used again for the same purpose, and the quantities recovered must be entered in the stock books. The permission for the use of the spirit may be withdrawn at any time, and the withdrawal gives no person any claim for compensation. If by death or any other cause a change in the firm occurs, a renewal of the permission must be obtained from the Department by the successors.

When for more than a year no "relatively" denatured spirit has been used, the authorised user must resign his permission, and sell or give over to some other authorised user any unused spirit, or return it to the Alcohol Department who will pay the market price for it.

The owner of the "relatively" denatured spirit must not sell it, or allow it to leave his manufacturing premises. Permission is given to sell such spirit denatured with—

(a) 5 litres of Wood Naphtha,
or (b) 3 „ of Acetone Oils,
or (c) 2 kilograms of Shellac, per hectolitre.

Such spirit cannot, however, be sold or given to any person who means to sell it again, but only to users of it in their own workshops. Not less than 5 kilograms of such spirit can be sold at a time, and if the person to whom it is sold does not hold a special permission for its use the total quantity he can receive annually must not exceed 150 litres (33 gallons).

Denatured spirit must not be used for any other purposes than those for which permission is given, and more particularly it must not be used in any way for making beverages, and no attempt must be made to remove wholly or partially from such spirit any of the denaturing substances, or to add other substances which would hide either the taste or smell of the denaturing substances. Nor must users of "relatively" denatured spirit in preparing with it articles for sale make so slight a change in the spirit that it practically remains only denatured spirit. In particular all varnishes, etc., must contain at least 6 per cent. of their weight of shellac or similar resin.

The sale of lacquers, varnishes, and polishes containing 6 per cent. of shellac is free. Dealers in all other products containing denatured spirit must obtain permission from the Alcohol Department.

Heavy penalties may be imposed for any breach of the laws or regulations.

The prices at which authorised users of "relatively" denatured alcohol can obtain their spirit from the Alcohol Department are fixed for periods of five years, according to the average prices paid by the Department for spirit during the preceding five years.

The present prices per 100 kilograms net at 95° are as follows:—

(*a*) Sekunda-Sprit - - - 47·0 francs.
(about 1s. 4½d. per gallon at 66 o.p.)

(*b*) Fein-Sprit or Rohspiritus - - 48·5 „
(about 1s. 5d. per gallon at 66 o.p.)

(*c*) Prima-Sprit - - - - 51·5 „
(about 1s. 6d. per gallon at 66 o.p.)

(*d*) Kahlbaum-Sprit or Wein-Sprit - 53·5 „
(about 1s. 7d. per gallon at 66 o.p.)

The same discounts are given for large orders as in the case of "absolutely" denatured spirit.

The authorised user has to bear the cost of the carriage, and of the denaturing substances in addition. Until recently authorised users were permitted to buy their own alcohol from abroad and to import it through the Department on payment of an import duty of 8 francs per 100 kilograms (about 2½d. per gallon). In future all alcohol must be bought from the Federal Alcohol Department, and the prices for the year 1905 have been fixed as follows:—

(*a*) Sekunda-Sprit at 41·0 francs per 100 kilograms at 95°.
(1s. 2½d. per gallon at 66 o.p. = 8½d. per proof gal.)

(*b*) Fein-Sprit or Rohspiritus at 42·50 francs per 100 kilograms at 95°.
(1s. 3d. per gallon at 66 o.p. = 9d. per proof gal.)

(*c*) Prima-Sprit at 45·50 francs per 100 kilograms at 95°.
(1s. 4d. per gallon at 66 o.p. = 9¾d. per proof gal.)

(*d*) Wein-Sprit at 47·50 francs per 100 kilograms at 95°).
(1s 5d. per gallon at 66 o.p. = 10¼d. per proof gal.)

Authorised users who order at one time one or more tanks of about 10,000 kilograms net content (2,700 gallons) enjoy a discount of 5 per cent. off these

prices if they give the Alcohol Department a period of 30 days for the execution of their order when foreign kinds of spirit are required.

For all other large orders of over 5,000 kilograms gross weight the usual official discount will be given.

The annexed tables give the quantities of the "absolutely" denatured spirit, and of the different kinds of "relatively" denatured spirit used in 1903, and also the principal purposes for which the latter spirit was used.

QUANTITY of DENATURED SPIRIT of all kinds sold in 1903.

	Kilograms at 93° to 95°	Equivalent Gallons at 63 to 66 o.p.
"Absolutely" Denatured	4,758,003	1,284,660
"Relatively" Denatured:		
From Monopoly	110,980	—
„ Importations	1,567,602	—
	1,678,582	453,217
Total	6,436,585	1,737,877

QUANTITY of "RELATIVELY" DENATURED SPIRIT used in SWITZERLAND in 1903.

Nature of the Manufacture, etc., in which the Spirit is used.	Number of Factories or Users.	Quantities of Alcohol used.	
		Kilograms at 95°.	Equivalent gals. at 66 o.p.
Vinegar making	19	225,849	60,980
For lacquers and varnishes	154	169,767	45,837
Manufacture of dyes	8	311,581	84,127
For dissolving dyes for cotton factories	6	9,150	2,470
For soaps and perfumery	11	8,376	2,262
For scientific purposes	18	4,048	1,093
Chemical products	27	133,231	35,972
Surgical dressings	3	782	211
Gummed tissues	3	6,049	1,633
Tobacco manufacture	1	17	5
Artificial silk	2	603,731	163,007
Celluloid	1	8,758	2,365
Smokeless powder	1	2,952	797
Fulminate of mercury	1	10,932	2,952
Acetic ether	1	91,759	24,775
Grafting wax	1	258	70
Electrotyping	1	280	76
Preparing cotton goods	1	16,069	4,339
Making mixture to prevent freezing of gaspipes	1	2,536	685
Preserving natural history specimens	1	252	68
„ botanical specimens	3	438	118
In photo-chemical works	2	850	230
		1,607,665	434,072

DENATURING SUBSTANCES used for "RELATIVE" DENATURING, and QUANTITY of ALCOHOL DENATURED with each.

	Denaturing Substances.	Quantity of Alcohol denatured.	
		Kilograms at 95°.	Equivalent Gallons at 66 o.p.
1.	Shellac, with or without the addition of camphor, turpentine, wood naphtha, &c.	52,340	14,132
2.	Colophony resin	3,974	1,073
3.	Copal resin	2,455	663
4.	Camphor	22,551	6,089
5.	Turpentine	98,210	26,517
6.	Acetic acid	257,186	69,440
7.	Nitric acid	1,241	335
8.	Acetic ether	3,532	953
9.	Ethylic ether	628,566	169,713
10.	Wood naphtha	15,751	4,253
11.	Pure methyl alcohol	11,419	3,083
12.	Wood naphtha and pyridine	352	95
13.	Acetone Oil	1,748	472
14.	Methyl violet (dye)	132,350	35,734
15.	Methylene blue (dye)	524	141
16.	Aniline blue (dye)	10,711	2,892
17.	Eosin (dye)	133,552	36,059
18.	Fluorescein (dye)	87,038	23,500
19.	Naphthalein	9,463	2,555
20.	Soap and castor oil solution	4,367	1,179
21.	Coal tar oil	12,670	3,421
22.	Benzol	3,100	837
23.	Nitrobenzol	513	138
24.	Phenol	739	200
25.	Pyridin	87,817	23,710
26.	Caustic Soda	15,244	4,116
27.	Piperonal	2,423	654
28.	Musk	8,275	2,234
29.	Animal oil	54,780	14,790
30.	Ethyl chloride	1,243	336
31.	Chloroform	128	34
32.	Formalin	220	59
33.	Undenatured (for manufacture of munitions of war)	13,609	3,674
		1,678,091	453,081

APPENDIX No. VI.

REGULATIONS AS REGARDS USE OF SPIRIT FOR INDUSTRIAL, ETC., PURPOSES IN AUSTRO-HUNGARY, RUSSIA, HOLLAND, UNITED STATES, BELGIUM.

AUSTRO-HUNGARY.

The Spirit taxes in Austria and Hungary are:—

CUSTOMS (Import).

On Liqueurs, Punch Essence, Sweetened Spirits, Arrack, Rum, French Brandy and Cognac:—150 kronen (£6) per 100 kilograms, equivalent to about 4s. per bulk gallon.

On all other spirits:—

110 kronen (£4 8s.) per 100 kilograms, equivalent to about 3s. 3d. per bulk gallon.

These duties are in addition to the highest Excise Duty payable in the country on spirits of the same description.

EXCISE.

Austria.—90 kronen (75s.) per 100 litres pure alcohol, equivalent to 1s. 11d. per proof gallon.

Hungary.—100 kronen (83s. 4d.) per 100 litres of pure alcohol, equivalent to 2s. 2d per proof gallon.

DUTY FREE SPIRIT.

Ordinary Methylated Spirit is made by mixing with alcohol of at least 90° (58 o.p.)

2 per cent. Wood Naphtha,

½ per cent. Pyridine bases, and a

Trace of phenolphthalein.

A Tax equivalent to about one-third of a penny per gallon is charged for denaturing.

For Varnishes, fulminate of mercury, hat-making, etc.

½ per cent. of turpentine is the denaturing agent.

For Vinegar the spirit is mixed with "Anhydride."

Very small quantities of pure alcohol are used for scientific purposes under certain conditions free of duty.

RUSSIA.

CUSTOMS AND EXCISE DUTIES ON ALCOHOL.

CUSTOMS (Import).

16 roubles 20 copecks per poud, equivalent to 34s. 6d. per 36 lbs. As in Germany, probably the weight of the vessels is included, and no very exact comparison can be made with the British standard. Approximately, the tax may be taken at 10s. to 12s. per proof gallon.

EXCISE.

The sale of alcohol is a monopoly in Russia, and distillers have to hand over their produce at fixed rates.

DUTY FREE SPIRIT.

ABSTRACT OF RUSSIAN REGULATIONS.

Persons wishing to use spirit duty free must apply to the Minister of Finance. Permission is generally limited *to one year.* Security for the duty (bond) must be given.

The quantity of spirit allowed is determined each year, and "depends on the productive power of the manufactory, conditions for disposal of manufactured article, scale of annual consumption of spirit," etc. The spirit is issued from distilleries, rectifying works, etc., on production of the order of the Finance Minister. It is received and examined at the factories by Excise Officers, and after *having been denatured,* is placed under revenue seal in a special store and is only issued as required by an Excise Officer. Accounts of receipt and issue are strictly kept, and sent to auditing authorities at the end of each year.

As a general rule a special Excise Controller is attached to each works for constant supervision of the proper use of the duty free spirit, and the proprietor of the works is bound to provide him with proper dwelling accommodation and with furniture and fuel.

Foreign spirits cannot be imported duty free.

Denaturing Processes employed :—

1. *For Varnishes and Polishes.*

100 parts spirit are mixed with 5 parts wood naphtha, and 1 part of turpentine, or instead of turpentine resin, shellac, tar, etc., may be used in the proportion of $\frac{1}{2}$ lb. to one vedro (2·7 gallon of spirit).

2. *For the preparation of Wine Vinegar.*

The spirit is diluted with water and vinegar, so that it shall be of a strength of 12° Tralles (79 u.p.), and contain 1 per cent. of acetic acid.

3. *For the preparation of Ether, Chloroform, Chloral Hydrate and Iodine.*

20 "lots" of animal oil to 100 Vedros (270 gallons) of spirit.

4. *For the preparation of Tannin and Collodion.*

To 100 parts of spirit 10 parts of sulphuric ether are added.

5. *For the preparation of Santonine.*

Fresh spirit is mixed with spirit that has already been used in the proportion of 4 parts of fresh spirit to one part of used spirit, or 36 lbs. (1 poud) of crude santonine is mixed with (10 Vedros) 27 gallons of spirit

6. *For the preparation of Phenacetin, Salol, Salipyrine and Salicitine-Nitro Salts.*

5 per cent. of benzol is added to the spirit.

7. *For the preparation of Aniline Dyes.*

5 parts of wood naphtha to 100 parts of spirit, or the spirit is mixed with animal oil in the proportion of 20 lots of oil to one Vedro of spirit (2·7 gallons).

8. *For the preparation of Artificial Silk.*

10 per cent. of sulphuric ether is added to the spirit.

9. *For the preparation of Resinite or Ksylite.*

7 per cent. of ether or acetone.

10. *For Smokeless Powder Manufacture.*

Spirit is not denatured, but there is strict registration and personal supervision of the Excise Officer.

11. *For Fulminate of Mercury.*

1/40th of 1 per cent. of animal oil (·025 per cent.), and 5 per cent. of the crude recovered spirit used in the process.

12. *For the Emulsic process, i.e. Extraction of Sugar from Treacle.*

Fresh spirit is mixed with the spirit that has already been used in the proportion of 1 part of fresh spirit to 1 part of used spirit.

13. *For Preventing Freezing of Gas Pipes.*

5 parts of wood naphtha and 1 part of pyridin bases to 100 of spirits.

14. *For Street Lighting in Towns.*

20 parts of turpentine to 100 parts of spirit; only issued to contractors to town councils, etc.

HOLLAND.

The Spirit Taxes in Holland are:—

EXCISE.

63 florins per hectolitre of alcohol at 50°, equivalent to about 5s. 6d. per proof gallon.

CUSTOMS (import).

A Surtax of 3·50 florins per hectolitre of alcohol at 50°, and in addition the Excise Tax of 63 florins=total 66·50 florins, equivalent to about 5s. 9d. per proof gallon.

DUTY FREE ALCOHOL.

ABSTRACT OF THE DUTCH REGULATIONS.

Ordinary Methylated Spirits.

1 litre wood spirit.

8 litres alcohol of at least 85° (49 o.p.)

This spirit is free to all who like to use it, on condition that it is not used in articles of human consumption, and that no attempt is made to purify it from methyl alcohol.

Vinegar Making.

1 hectolitre of alcohol at 50° is denatured with

1 hectolitre vinegar of 4 per cent. strength.
2 hectolitres water.

or

20 litres vinegar of 4 per cent.
20 ,, dried raisin juice

or

20 litres vinegar alone if Excise Officers see the mixture added to acidifying vessels.

Permission to receive methylated spirits must be renewed every year.

Wood spirit provided by Government at a fixed price to cover cost of methylating.

Excise keep accounts of quantity used. Vinegar-makers furnish returns of vinegar made.

Specimens in spirit for teaching natural history may be imported duty free, and no Excise duty is charged.

Foreign made varnishes containing wood naphtha equal to home-made may be imported duty free.

Duties on		
Chloral hydrate - - -	fl 1.30	per kilogram.
(1) Ether sulphuric - - -	„ 2.20	„ „
(2) „ acetic - - - -	„ 1.20	„ „
(3) Collodion - - - -	„ 1.90	„ „
Chloroform - - - -	„ 1.50	„ „
Nitrous ether - - - -	„ 1.30	„ „
Wood Spirit - - - -	„ 1.15	„ litre.

(1) Exempt when required for use in making smokeless powders and glazing porcelain.

(2) Exempt when required for use in making smokeless powders and glazing porcelain.

(3) Exempt when required for incandescent mantles.

Other similar products pay the same Surtax and Excise as 24 litres of alcohol at 50°.

UNITED STATES.

The Customs and Excise duties on Alcohol in the United States are:—

CUSTOMS.

$1.75 (Minimum Reciprocity Tariff),

$2.25 (General Tariff),

Per American Proof Gallon; equivalent to 10s. to 12s. 10d. per British Proof Gallon.

EXCISE.

$1.10 per American Proof Gallon; equivalent to 6s. 3d. per British Proof Gallon.

DUTY FREE ALCOHOL.

There appears to be nothing equivalent to British methylated spirit or denatured spirit of any kind in the United States.

The only duty free alcohol of any kind is that which is supplied in very small quantities to certain schools and colleges for use in Education and research.

BELGIUM.

The Customs and Excise Taxes on Alcohol in Belgium are:—

CUSTOMS (Importation)

175 francs per hectolitre at 50°, and 3.50 francs for each degree over 50 for ordinary spirits in bulk (equivalent to 7s. per proof gallon).

In bottles 350 francs per hectolitre. Other alcoholic liqueurs at 350 francs per hectolitre.

Food preparations preserved in alcohol, 175 francs per 100 kilograms.

Wood spirit, methyl and amylic alcohol, and all homologues pay Customs duty.

EXCISE (Internal),

Excise on home-made spirits is 150 francs per hectolitre at 50° (equivalent to 6s. per proof gallon).

Agricultural Distilleries obtain a rebate of the Excise Duty, equal to 8 to 10 francs per hectolitre at 50° (equivalent to 4d. to 5d. per Proof Gallon).

DUTY FREE ALCOHOL.

ABSTRACT OF THE BELGIAN REGULATIONS.

Since 1896 alcohol has been allowed duty free in a few manufactures, and in a number of others a proportion of the duty is returned after the alcohol has been mixed with certain denaturing agents.

Manufacture, etc.	Denaturing agent used per hectolitre of alcohol at 94° or over (64 o.p.).	Duty remitted per hectolitre at 50°. (Excise duty 150 francs.)
		Francs.
Vinegar - -	300 litres of water, and 100 litres of vinegar containing 8 per cent. acetic acid - - - - - - - -	120
Varnish - -	*For use in workshops where made* :—8 litres methyl alcohol (wood spirit) containing 5 per cent. acetone and 25 litres of varnish containing 30 per cent. gum resin - - - - - - - - - -	114
	For sale :—10 litres wood spirit containing 5 per cent. acetone, and 25 litres varnish containing 30 per cent. gum resin - - - - - - - - - -	
Aniline colours -	10 litres wood spirit containing 5 per cent. acetone, and 25 grams fuchsine or other aniline colour - - -	140
Hats - - -	10 litres wood spirit containing 5 per cent. acetone, and 25 litres varnish containing 30 per cent. gum resin -	140

Manufacture, etc.	Denaturing agent used per hectolitre of alcohol at 94° or over (64 o.p.).	Duty remitted per hectolitre at 50°. (Excise Duty 150 francs.)
Artificial flowers	10 litres wood spirit containing 5 per cent. acetone, and 15 grams aniline colours	140
Frame gilding	20 litres wood spirit containing 5 per cent. acetone, or 3 litres ethyl methyl ketone	114
Firework materials	10 litres wood spirit and 5 kilog. gum accroide	140
Refining and washing raw oils	10 litres sulphuric acid at 66° B	140
Transparent soap	5 litres ess. of lavender, aspic of citronella	140
Mercury fulminate	10 litres of crude ethers, recovered in process	140
Collodion for use in workshop where made	50 litres common ether	140
Tannin	50 litres common ether	140
Pegamoids, etc.	5 litres acetone, or 2 litres ethyl methyl ketone, or 25 litres ether	140
Smokeless powder	3 litres ethyl methyl ketone	140
Peptones from brewing yeasts	3 do. do.	140
Tineacidine, a disinfectant	3 do, do.	150
Antiseptics and medicaments	3 do. do.	140
Quinoline yellow	3 litres acetone oil	150
Gazage de ficelles	4 do. do	140
Artificial silk	150 litres common ether	150
Soldering metals	3 litres of mixture of equal parts of ethyl methyl ketone and acetone oil	140
Acetic ether	15 litres of acetic ether residues	150
Sulphuric or common ether	10 litres of sulphuric ether residues	150
Anatomical, etc., preparations in superior schools	500 grams nitrobenzol, 500 grams camphor, or 1½ litres methyl ethyl ketone	140

Duty free alcohol for heating and lighting has not yet been allowed. In a note to our Ambassador (February, 1902) the Belgian officials say :—

> "The point is under consideration and the Government are following attentively what is being done in foreign countries, notably in Germany and France. The question, however, has not the same interest in Belgium as in those countries. In France and Germany petrol pays a heavy import duty, while in Belgium it is free from any tax. From an economic point of view it seems probable that it will be always more advantageous to use petrol than alcohol even free of all duty for those purposes in Belgium."

Apparently the only products containing methylated spirits that can be sold are varnishes.

All the other denatured spirits are for use in the factories only, and the denaturing is done under the supervision of officers at the works. Accounts have to be kept at the works of the quantity of methylated spirits used daily. Excise officers frequently take stock of the methylated spirit, and may verify quantities of products made. No stills allowed on works, except when specially authorised under exceptional circumstances.

Two hectolitres at 50° (44 gallons) is the minimum quantity that can be denatured.

Quantity of spirits on which duty remitted in 1901, 21,292 hectolitres (468,424 gallons). Of this—

150,000	gallons	were	used in	making common ether.
121,000	,,	,,	,,	vinegar.
105,000	,,	,,	,,	varnishes.
58,000	,,	,,	,,	artificial silk.
434,000				

Leaving 14,000 gallons for the other trades.

The conditions under which denatured spirit is allowed in Belgium are evidently less favourable than in this country, as, exclusive of the cost of the denaturing agents, a duty of about 5d. per proof gallon, or 8d. at 60 over-proof is charged.

By a law passed in 1902 the Belgian Government is authorised to grant total or partial exemption from the import tax on alcohols intended to be used exclusively for industrial purposes. The alcohol must first be denatured.

The following table shows the quantity of denatured alcohol used in the various kinds of industry in Belgium since the beginning of 1902.

TABLE SHOWING for each class of Industry, the QUANTITIES of DENATURED ALCOHOL USED during the Years 1902, 1903, and the first Nine Months of 1904.

Class of Industry.	Quantity of Denatured Alcohol used		
	1902.	1903.	Nine Months of 1904.
	Gallons at 50°.	Gallons at 50°.	Gallons at 50°.
Vinegar	174,218	276,760	240,548
Varnish	117,194	123,244	88,462
Aniline Colours	1,628	2,508	2,178
Hats	3,212	2,354	6,160
Fulminate of Mercury	176	3,146	10,230
Collodion	1,122	3,058	2,838
Artificial Flowers	—	—	—
Frame Gilding	308	352	308
Transparent Soap	264	528	792
Refining and Washing Raw Oils	198	—	198
Tannin	—	—	—
Anatomical or Scientific Preparations	638	1,100	550
Antiseptics and Medicaments	3,762	5,962	8,426
Pharmaceutical or Chemical Products	2,508	3,366	3,366
Simili Leather	6,842	462	—
Smokeless Powder	—	—	1,408
Peptones	—	—	—
Acetic Ether	4,268	4,004	—
Sulphuric Ether	308,748	568,194	514,228
Artificial Silk	144,496	325,248	376,816
Alcohol for dissolving Resin used for soldering Metal Boxes	286	660	264
Quinoline Yellow	—	440	330
Tineacidine (disinfectant)	88	154	44
Firework Materials	—	—	—
Gazage des ficelles	—	44	—
TOTALS	769,956	1,321,584	1,257,146

INDEX.

ACETONE:
High price and scarcity owing to increased demand (Cocking), 3566-7, etc.
Manufacture from acetate of lime (Conroy), 3225-6; not on large scale (Cocking), 3738-71.
From alcohol not commercially possible at present (Cocking), 3616-7, etc.; methylated spirit not suitable (Cocking), 3618.
From wood naphtha in Germany, not in England (Biggs), 4331-4, 4357-64.
Maximum quantity allowed in wood naphtha for methylation, Appendix No. II, p. 236.

ALCOHOL:
Absolute, a relative term (Dreyfus), 1643-56, can be obtained from English distillers (Dreyfus), 1653-4; (Nicholson), 5199-201.
anufacture:
Conditions in England and Germany compared (Ormandy), 1101-13: (Nicholson), 5154-80.
Excise restrictions, cost to distillers (Nicholson), 5091-122; (Walker), 5261-5; Appendix No. I. p. 229; are fair and necessary as they exist (Nicholson), 5096-7.
Excise supervision must be same for industrial as for other spirit (Walker), 5300; should be strict in interests of distillers (Nicholson), 5156-8.
Extended use under Finance Act, 1902, probable imits of expansion, Sub-Committee Report, section 9, p. 27; probable effect on wood Naphtha industry (Biggs), 4284-93.
Plain British spirit for industrial purposes:—
Different in quality from spirit for drinking purposes (Nicholson), 5067-81.
High strength can be produced if required (Nicholson), 5199-201.
Increasing demand for better quality (Nicholson), 5191-5.
Manufacture separate from spirit for drinking not practicable (Nicholson); 5126-35; (Walker), 5300-3.
Materials used (Nicholson), 5065-71; 5136-8, 5151-2,
Output could be increased (Nicholson), 5217-8; (Walker), 5250-6.
Prices (Nicholson), 5084-7, 5144-5.
Retention in bond not usual (Nicholson), 5213-6.
Surtax, Appendix No. I., p. 229.

ALIZARINE, home production and imports compared (Perkin), 1227-30; manufacture in England, decadence not due to restrictions on alcohol (Meldola), 1414; revival (Perkin), 1241-3; (Meldola), 1415-6.
Price controlled by Germany (Ashworth), 4584.

ANILINE DYES, *see* "Coal Tar Colours."

ARTIFICIAL SILK, *see* "Silk (Artificial.)"

AZO COLOURS require no alcohol except in a few cases (Friswell), 6, 83; (Green), 323; (Ree), 884-7.
The result of discoveries abroad (Friswell), 12-3.

CHEMICALS (FINE), imports from Germany (Conroy), 3123-45; manufacture in Germany, Sub-Committee Report, Section 4; price often higher in England than Germany in cases where no alcohol is required, reasons suggested (Howard), 2675-86; (Ashworth), 4665-72, 4681-5.

CHLORAL HYDRATE, adequacy of import duty questioned (Howard), 2607-11, 2665-7; manufacture from methylated spirit not profitable (Conroy), 3227-38.

COAL TAR COLOURS:
Alcohol, its present importance (Friswell), 6-7, 83-9; (Levinstein), 152-6; (Green), 429-67; (Perkin). 1163-7, 1210-5; (Meldola), 1410-1, 1417, 1422-3, Sub-Committee Report, Section 2;

COAL TAR COLOURS—*cont.*
Alcohol—*cont.*
Price, duty-free, prevents practical utility of Finance Act, 1902 (Levinstein), 236, 201-2; (Dreyfus), 1507-10; must be same as in Germany to make competition possible (Levinstein), 221-35; (Green), 374-7; (Dreyfus), 1507-10; difference of 6d. a gallon prohibitive (Levinstein), 183-6; (Green), 350-1; (Meldola), 1417.
Restrictions on, how far the cause of decadence of the English industry (Friswell),16-21, 80-2; (Levinstein), 277-80; (Green), 414-7; (Rée); 788-90, 890-2; (Perkin), 1147-8, 1176-82, (Meldola), 1403-9, 1412-3, 1420-3, 1465; no concerted action for their removal prior to 1902 (Rée), 838-42; (Dreyfus), 1579-81.
Decadence of the English industry, causes (Friswell), 16-21, 126-9; (Levinstein),277-80; (Green),417-8; 499-501; (Rée), 788-90, 890-4; (Perkin), 1149-62; (Meldola), 1420-33, Sub-Committee Report, Section 2; not confined to colours requiring alcohol (Meldola), 1412-6.
Denaturants for alcohol, considered unnecessary (Green), 347-9; special allowed prior to 1902, for making dimethyl aniline (Green), 318-21; for recovered methylated spirit (Rée), 773-83, suggested for general use, petroleum or pyridine bases (Green), 508-18.
Ether, for colours and intermediate products (Green), 544; (Meldola), 1407, 1435-7.
Export trade, before 1874 (Perkin), 1159-60: from 1874 to 1899 (Friswell), 22-5; present time (Levinstein), 217-8; (Turner), 4388-96.
High selling prices formerly as compared with present time (Friswell), 68-9; (Levinstein), 149-51; (Perkin), 1168-72; (Meldola), 1411.
History of English industry, 1870 to 1885 (Meldola), statement, p. 59.
Importation, began about 1855 (Friswell), 14-6, 26; present figures (Conroy), 3128-30, 3145 (Note); how far due to restrictions on alcohol in England (Perkin), 1231-40; (Meldola), 1402-8.
Intermediate products requiring alcohol, relative number and importance (Green), 429-39.
Methylated spirit, as alkyiating agent, unsuitable (Levinstein), 190-1, 231; (Green) 333-9.
As solvent for finished dyes (Friswell), 8-9, 28; (Levinstein), 187-9; (Perkin), 1132-7; (Whitaker), 3970-6; use decreasing (Turner), 4526-7.
As solvent for raw products (Perkin), 1132-7; (Meldola), 1383-92.
Patents, comparatively few modern colours subject to (Rée), 790, 850-2.
Prospects of reviving industry in England with freer alcohol (Levinstein), 154-6, 201-4, 268; (Green), 374-7, 503-4; (Rée), 788-90; (Perkin), 1189; (Meldola), 1448-52; (Ashworth), 4585-6; with duty-free methyl alcohol (Green), 526.

COLLODION for photographic purposes— duty-paid alcohol used (Entwistle), 690-3; (Clarke), 3789-806.
Ether suggested as denaturant (Macwalter), 4141-3, 4171-3.
Methylated ether used (Entwistle), 745-7; (Howard), 2590; (Clarke), 3801.
Methylated spirit, objections to its use (Entwistle), 734-42; (Clarke), 3819-21; (Macwalter), 4116-26, 4182-9; cost not serious (Macwalter), 4158-70.

COLLODION EMULSION, manufacture under Financ Act, 1902, cost of supervision only justified by manufacture on wholesale scale (Clarke), 3839-43.
Methyl alcohol or high grade wood naphtha suggested as denaturant (Clarke), 3846-72.

CORDITE, acetone as solvent (Tulloch), 2301.
Alcohol-ether mixture as solvent (Cocking), 3590–2.
Alcohol for drying process (Tulloch), 2393.
Manufacture hindered by scarcity of acetone (Cocking), 3589.

DENATURANTS: (*See also* "Wood Naphtha.")
Substances used abroad, Appendices III. to VI.
Under Finance Act, 1902, *see* "Fulminate of Mercury," "Tolidine," "Xylonite."

DIMETYHLANILINE, imported, not made in England, the reasons (Friswell), 33–5, 112–9; (Rée), 899–910; (Meldola), 1434, and Statement p. 61; manufacture stopped by foreign competition (Turner), 4397.
Manufacture from products of Vinasse (Friswell), 95; (Meldola), 1404.
Methyl alcohol, a relatively large constituent (Friswell), 38, 77–9; must be pure (Meldola), 1404, and Statement p. 61; (Dreyfus), 1484; impurities reduce yield without affecting quality (Turner), 4481–9.
Pure methyl alcohol allowed with special denaturant before 1902 (Green), 318–21; (Dreyfus), 1567–78.

DISPLACEMENT PROCESS in making explosives, alcohol would obviate dangerous drying process (Griffith), 1679–81; (Tulloch), 2377–80, 2391–2; (Silberrad), 2415.
Finance Act, 1902, its applicability (Griffith), 1705–7; Bone oil a possible denaturant (Cocking), 3643.
Methylated spirit unsuitable except for sporting powders (Griffith), 1765–84; the reasons discussed (Silberrad), 2419–515.
Pure alcohol considered essential (Tulloch), 2398–407.

DYEING, advantage of alcoholic solution (Turner), 4546–8; loss of spirit (Whitaker), 4076–9.
Water, disadvantages of using (Whitaker), 4020–4; use of distilled water discussed (Whitaker), 4025–42, 4067–75.

DYES, *see* "Coal Tar Colours."

ETHER, Customs Duty on, adequacy questioned (White), 5342–64.
Denaturants suggested, bone oil (White), 5389–99; oil of ether (White), 5448–60
For medicinal purposes, question whether use of duty-paid spirit should be insisted on (Howard), 2585; (White), 5435–47.
Methylated (made from methylated spirit):
Allowance on export suggested (White), 5365–86, 5416–25.
Can be used for artificial silk (Cash), 5544–9; for photographic collodion (Entwistle), 745–7; (Howard), 2590; (Clarke), 3801; for refrigerating purposes (White), 5371; for smokeless powders (Tulloch), 2323; (Cocking), 3557–63.
Cannot compete as to price with German ether in colonies (Howard), 2584; (White), 5367–70
Home market not affected by restrictions on alcohol (White), 5412–3.
May be made from same plant as pure ether (White), 5461.
Sulphuric (made from pure spirit):
Cannot be produced at price of imported ether (White), 5331–41, 5413–5.
Manufacture in bond suggested (Howard), 2583–4; (White), 5397–9, 5426–34.

FATS and oils, alcohol process for refining (Rée), 801; (Ormandy), 989–95; (Edwards), 3889–957.
Excise supervision necessary under Finance Act, 1902 (Rée), 809, 862–71; (Edwards), 3933–6.
Methylated spirit, considered unsuitable (Rée), 802–4; (Edwards), 3899–902, but *see* (Rée), 911–4, and (Edwards), 3937–51; too expensive (Rée), 857–9.

FINANCE ACT, 1902, Section 8:
Board of Inland Revenue, attitude towards experimental work with alcohol motors (Boys), 4810; towards manufacturers on small scale (Umney), 2877–80; towards use of pure spirit for laboratory work (Dreyfus), 1588–90; (Conroy), 3209–10.

FINANCE ACT, 1902, Section 8—*cont.*
Board's Minute on the section, Appendix No. II., p. 239. Procedure to be observed by traders desiring to avail themselves of its provisions, Appendix No. II., p. 241.
Regulations as to use of pure spirit in colleges, etc., Appendix No. II., p. 241.
Scope not realised (Dreyfus), 1632–4; (Conroy), 3280–3; (Cocking), 3568–74; (Edwards), 3958–9.
Working under existing regulations, *see* "Fulminate of Mercury," "Tolidine," "Xylonite."

FULMINATE OF MERCURY, manufacture under Finance Act, 1902 (Smith), 4902–5061.

GERMANY:
Pre-eminence in chemical industries, causes of (Rée), 897–8; (Ashworth), 4673–80.
Production and distribution of alcohol (Ormandy), 1074–1100, 2141; (Walker), 5283–92 and Statement, p. 203; Sub-Committee Report, Section 9, p. 24.
Regulations as to use of spirit for industrial, etc., purposes, Appendix No. III., p. 248.
Research work in colour factories and its results (Levinstein), 172; (Perkin), 1193–9; (Meldola), 1453–64; (Umney), 2882–92; (Ashworth), 4613–30.

GOVERNMENT LABORATORY, methylated spirit used in almost all operations requiring alcohol (Conroy), 3213.
Specification of tests for wood naphtha for methylation, Appendix No. II., p. 236.

INDIGO (synthetic) how far it competes with natural indigo (Levinstein), 269–74.
Prices controlled by Germany (Levinstein), 257–8.

LABORATORY WORK, attitude of Board of Inland Revenue to use of duty-fee pure spirit (Dreyfus), 1588–90 (Conroy), 3209–10.
Methylated spirit (ordinary) used in Government laboratory (Conroy), 3213.

LACQUERED GOODS, export trade (Bagley), 1870–2; 1878–81.
Foreign competition in home market (Barlow) 1948–51; (Reid), 2953–5.
Foreign goods considered superior to English (Bagley), 1854–9, 1870–2; (Barlow), 1948–51; (Reid), 2941–2; (Gittings), 3386–9.
Specimens exhibited to illustrate superiority of pure spirit lacquer (Bagley), 1842–50; (Barlow), 1906–11; *see also* (Reid), 2988–93 (Giltings), 3350–6.

LACQUERS:
Denaturants used abroad, Appendices III. to VI. Sub-Committee Report, p. 14.
Excise supervision necessary under Finance Act 1902 (Bagley), 1860–1; (Barlow), 1914–21, 1941–5; (Gardiner), 2177–208.
Export trade (Barlow), 1922–6; (Gardiner), 2234–47; (Gittings), 3380–404.
Imported, no ground for retaining Customs duty if duty-free pure spirit were used in this country (Reid), 2952–3; (Conroy), 3194–5; removal of duty not feared in such case (Gittings), 3343–9.
Methylated spirit considered quite suitable in character (Gardiner), 2167–76; (Conroy), 3196.
Pure spirit, duty paid, used for special purposes (Bagley), 1864–6; (Barlow), 1903–13; (Gardiner), 2163–6; (Gittings), 3377–9; price compared with ordinary lacquer (Bagley), 1836; (Barlow), 1907; (Gardiner), 2172.
Gives better results than methylated spirit (Bagley), 1834–50; (Barlow), 1889–913; (Reid,) 2955–60; (Cocking), 3549–56.
Shellac as denaturant, inadequate of itself to protect Revenue (Gittings), 3454–72.

LIGHTING AND HEATING, alcohol for:
Advantages over oil for lamps (Ormandy), 1001–3, 1021; (Massey), 4706–7, 4733, 4741–2; purity not essential (Ormandy), 1004, 1013–4.
Cheapness essential to general use (Rée), 831–4; (Ormandy), 1004, 1014; present price prohibitive (Massey), 4717–8, 4735–7.
Lamp exhibited (Massey), 4686, etc.
Methylated spirit (mineralised), suitable but too costly (Ormandy), 1005–14, 1046–52, 1067–8; (Dreyfus), 1545–50; (Massey), 4689–705, 4735–40; cost compared with electricity (Massey), 4697–8 and with kerosene (Massey), 4717–8.

METHYLATED SPIRIT (*See also* " Wood Naphtha ").
Composition, Appendix No. II. p. 233: (Silberrad), 2447-505.
neralised, Excise restrictions on sale, relaxation suggested (Biggs), 4242-4,4302-10; (Boys), 4785-6, 4824-5; how far they increase retail price (Walker), 5267-82.
Ordinary (unmineralised).
Alleged variable character discussed (Reid) 3002-17.
proved quality of recent years (Griffith), 1713-5; (Nicholson), 5191-5.
In chemical operations, not always unsuitable, except as regards cost (Rée), 824-7; used in Government laboratory (Conroy), 3213.
Special quality obtainable for special purposes (Dreyfus), 1513-29; (Griffith), 1665-6, 1752-64; (Clarke), 3854-72; (Edwards), 3952-5; (Biggs), 4314-30; (Cash), 5369-71.

MOTORS, adaptation of petrol cars for alcohol (Boys) 4783.
Alcohol as fuel for:
Complete denaturing necessary (Ormandy), 2009-11.
Corrosive effect (Boys), 4832-43; *see also* (Ormandy), 2027-42.
Experimental work, hindrances should be removed (Boys), 4803-9, 4823-6; attitude of Board of Inland Revenue (Boys), 4810.
Price prohibitive for general use (Ormandy), 2090-2; (Boys), 4811-2.
Suitability discussed (Ormandy), 2056-67; (Boys), 4788-91, 4832-52; compared with petrol (Ormandy), 2093-9, 2105-18; (Boys), 4771-9, 4788, 4813-22, 4895-7.
Alconol question, of future rather than present importance (Boys), 4766-70, 4787; important in view of condition of petrol market (Ormandy), 2069-89; (Boys), 4780-2.
Benzol as denaturant (Friswell), 102-7, 123-5; (Ormandy), 2016-26, 2100-4, 2142-56; (Boys), 4764-5, 4858-75.
Methylated spirit (mineralised) suitable (Ormandy), 2012-4; (Boys), 4759-64, 4827-8; but better without acetone and with constant proportion of water (Ormandy), 2014-5; may give rise to corrosion (Ormandy), 2027-42.

NITRO-CELLULOSE POWDERS:
Acetone as solvent (Griffith), 1677; its disadvantages (Tulloch), 2300-1; (Silberrad), 2415.
Alcohol, price of, effect on the industry in England (Tulloch), 2302-7, 2335-40; prohibitive effect of a difference of 6d. a gallon in competition with Gernany (Tulloch), 2355-71.
Pure, considered essential (Tulloch), 2386-8; need for, not severely felt before 1904 (Tulloch), 2332-4, 2341-2; emphasised by scarcity of acetone; (Cocking), 3613-4.
Recovery in manufacture (Tulloch), 2363-5, 2382-5.
Solvent action compared with that of methyl alcohol and wood naphtha (Cocking), 3679-706.
Alcohol-ether as solvent (Griffith), 1677-8; (Tulloch), 2300; (Silberrad), 2415; cost compared with acetone (Griffith), 1739-51.
Conditions of manufacture in Germany (Tulloch), 2343-53; Appendix No. III, p. 225.
Ether, methylated ordinarily suitable (Tulloch), 2323; (Cocking), 3557-63; pure considered essential in special case; (Tulloch), 2314-27.
Future of (Tulloch), 2381; (Reid), 2901-2; (Cocking), 3604-6.
Methylated spirit, defects of powder made with (Reid), 2896-900; (Cocking), 3557-64, 3593-600; reasons discussed (Silberrad), 2419-532; (Reid), 3000-19; (Cocking), 3721-35.
Strict supervision over workmen minimises risk of misuse of spirit (Griffith), 1805-28; (Tulloch), 2394-5; (Reid), 2904.

PHARMACEUTICAL PREPARATIONS:
Alcohol, price in England not always prohibitive (Green), 356-64; prevents manufacture in certain cases (Green), 365-8; (Webb), 2705.
Conditions of manufacture in Germany, Sub-Committee Report, Section 4; Appendix No. III., p. 252.
Export trade (Grimwade), 1972-88; (Webb), 2704-50.
Manufacture under Finance Act, 1902:—
Co-operative working suggested (Howard), 2591-6 (Umney), 2822-6.
Cost of Excise requirements justified by aggregate importance of many items (Howard), 2578-9; *see also* (Umney), 2817-9.
Extent of supervision necessary (Howard), 2580-1; (Umney), 2872-6.
rospects of meeting German competition (Howard), 2597-606; (Webb), 2748-53; (Umney), 2830-8, 2852-4.
Variety of special denaturants required (Howard), 2582, 2628-33; (Umney), 2847-8.
Methylated spirit, disadvantage as regards cost (Howard), 2564-7; cost of methylation not serious if only 3d. a gallon (Howard), 2644-64.
Disadvantage as regards character (Howard), 2564; can be used in some cases (Howard). 2571-3; but in many is quite unsuitable (Howard), 2574-5.

POTATOES, as source of alcohol:
More expensive than grain (Ormandy), 1101-13; (Nicholson), 5139-43; (Walker), 5310.
Not a profitable industry for Ireland (Hinchcliff), 5752-86.
The industry in Germany (Ormandy), 1101-13; (Hinchcliff), 5658-751, Sub-Committee Report, Section 5.

SILK (Artificial):
Conditions of manufacture in Germany, Sub-Committee Report, Section 8.
Coventry enterprise, 1898 to 1900, evidence of Mr. J. Cash, 5404-5655.
Excise supervision, extent necessary under Finance Act, 1902 (Cash), 5591-9.
Methylated spirit considered unsuitable (Cash), 5470; experiments with special quality (Cash), 5489-94, 5506-16, 5565-76.
Prospects of success in this country with advantage of the Finance Act, 1902 (Levinstein), 250-6; (Cash), 5617, 5643-9.
The industry abroad (Cash), 5600-13; initial difficulties experienced (Levinstein), 250; (Cash), 5498-502.

SMOKELESS POWDER, *see* " Nitro-cellulose Powder."

SOAP (Non-transparent):
Alcohol not necessary (Wigglesworth), 558-64; but could be used with advantage (Wigglesworth), 560-3; (Ormandy), 949-55.
Transparent):
Alcohol, objects and method of use (Wigglesworth), 653-61; not essential for inferior qualities (Wigglesworth), 554-6; (Edwards), 3959-62.
Finance Act, 1902, difficulty in application owing to Customs duty on imported article (Ormandy), 957; removal of the duty not a serious matter if advantages of the Act were given (Wigglesworth), 627-9, 674-8.
Methylated spirit, suitable except for smell (Wigglesworth), 612, 650; smell necessitates strong and expensive perfumes (Wigglesworth), 572-3, 613-23; price not a serious matter (Wigglesworth), 574-5. 606-9.

SPORTING POWDERS:
Methylated spirit of special quality used for hardening (Griffith), 1665-6, etc.; disadvantage as regards cost (Griffith), 1683-93.
Could be used in displacement process (Griffith), 1776-7.
ot adaptable for military purposes (Tulloch), 2375.
Pure spirit not essential (Griffith), 1786-8.

SURTAX on foreign spirit, Appendix No. I. p. 229,

SYNTHETIC PERFUMES:
Cost of alcohol (duty-free) not prohibitive owing to wide margin of profit (Green), 369–73; (Dreyfus), 1511–2.
Extent of Excise supervision necessary under Finance Act, 1902 (Ormandy), 970–4, 1115–24.
Importance in making soap (Ormandy), 966–7; value compared with soap itself (Ormandy), 967.
Methylated spirit unsuitable (Silberrad), 2547–53.
Skill required in making (Ormandy), 1117–9; (Dreyfus), 1512.

TINCTURES:
Duty on alcohol no hardship (Howard), 2568–70; increased export under drawback arrangements (Webb), 2757–60; (Umney), 2840–1; (Conroy), 3149.
Separation of manufacture from that of preparations made with specially denatured spirit (Webb), 2768–80; (Umney), 2819–21.

TOLIDINE, manufacture under Finance Act, 1902 (Leitch), 3031–116.

VARNISH, *see* "Lacquer."

VINEGAR, manufacture from alcohol, Sub-Committee Report, Section 6.

WOOD NAPHTHA for methylation:
English standard specified, Appendix No. II., p. 236.
Effect of specification on the trade (Biggs), 4311–3; (Walker), 5314–20.
Allows of special quality being used for special purposes (Dreyfus), 1513–29; (Griffith), 1665–6, 1752–64; (Clarke), 3854–72; (Edwards), 3952–5; (Biggs), 4314–30; (Cash), 5569–71; not generally utilised for this purpose (Biggs), 4314–7.
German standard, Appendix No. III., p. 256.
Quality and strength used (Biggs), 4232–4; alleged variability discussed (Reid), 3000–17.
Quantity produced per ton of wood (Biggs), 4381.
Selling prices (Biggs), 4227–31, etc.; (Walker), 5232–3.
Sources of supply (Biggs), 4209–12, 4365–80.

XYLONITE, manufacture under Finance Act, 1902. (Merriam), 1247–1376.

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